

152
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AND

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MAGAZINE OF NATURAL HISTORY,

INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

(BEING A CONTINUATION OF THE 'MAGAZINE OF BOTANY AND ZOOLOGY,' AND OF
LOUDON AND CHARLESWORTH'S 'MAGAZINE OF NATURAL HISTORY.')

CONDUCTED BY

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VOL. III.—SECOND SERIES.  
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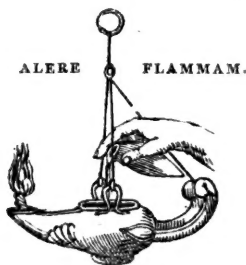
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“Omnes res creatæ sunt divinæ sapientiæ et potentiæ testes, divitiæ felicitatis humanæ:—ex harum usu *bonitas* Creatoris; ex pulchritudine *sapientia* Domini; ex œconomiâ in conservatione, proportione, renovatione, *potentia* majestatis elucet. Earum itaque indagatio ab hominibus sibi relictis semper æstimata; à verè eruditis et sapientibus semper exulta; malè doctis et barbaris semper inimica fuit.”—
LINNÆUS.

. The sylvan powers
Obey our summons ; from their deepest dells
The Dryads come, and throw their garlands wild
And odorous branches at our feet ; the Nymphs
That press with nimble step the mountain thyme
And purple heath-flower come not empty-handed,
But scatter round ten thousand forms minute
Of velvet moss or lichen, torn from rock
Or rifted oak or cavern deep : the Naiads too
Quit their loved native stream, from whose smooth face
They crop the lily, and each sedge and rush
That drinks the rippling tide : the frozen poles,
Where peril waits the bold adventurer's tread,
The burning sands of Borneo and Cayenne,
All, all to us unlock their secret stores
And pay their cheerful tribute.

J. TAYLOR, *Norwich*, 1818.



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ERRATUM.

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THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SECOND SERIES.]

“..... per litora spargite muscum,
Naiades, et circum vitreos considite fontes :
Pollice virgineo teneros hic carpite flores :
Floribus et pictum, divæ, replete canistrum.
At vos, o Nymphæ Craterides, ite sub undas ;
Ite, recurvato variata corallia trunco
Vellite muscosis e rupibus, et mihi conchas
Ferte, Deæ pelagi, et pingui conchyliis succo.”
N. Parthenii Giannettasii Ecl. 1.

No. 13. JANUARY 1849.

I.—*On some new genera and species of Palæozoic Corals and Foraminifera.* By FREDERICK M'COY, M.G.S. & N.H.S.D. &c.

ZOOANTHARIA.

*Petraia** *gigas* (M'CoY).

Sp. Char. Obtusely conical, slightly oblique, section elliptical; *internal cast* divided into forty broad, flat, smooth ribs, separated by the strong sulci of the principal lamellæ reaching to the centre; each of those ribs is divided by a fine mesial sulcus, the remains of the intermediate lamellæ, not reaching to the centre, making the total number of lamellæ about eighty. Length of imperfect cast 2 inches 7 lines; width of long axis at base 11 lines, at edge of cup 3 inches 7 lines (compressed), width of ribs 2 lines.

This large and strongly marked species from the number of its lamellæ can only be confounded with the *P. pluriradialis* (Phil. sp.) and *P. elongata* (Phil. sp.), from both of which it differs in its form and great size, width of ribs on the cast, absence of the punctures, &c. The strong primary lamellæ reach the centre with a very slight indication of twisting; the secondary ones are very delicate towards the base, but become nearly equal

* Having examined Count Münster's original specimens of several species of his genus *Petraia*, I have satisfied myself that they are really corals, as suggested by Mr. Lonsdale and others, although he describes them in his 'Beiträge' as Gasteropods, the publication of which view prevented Prof. Phillips adopting the genus in his work on the Fossils of Devon and Cornwall.

in strength to the others as they approach the edge of the cup. The denticulation of the lamellæ is scarcely perceptible.

Not uncommon in the fine gray Devonian slates of New Quay. (Col. University of Cambridge.)

Clisiophyllum Keyserlingii (M'Coy).

Sp. Char. Conical, slightly curved, terminal cell oblique, 1 inch 2 lines in diameter in a specimen 3 inches long; surface finely striated longitudinally (about eight striæ in one-fourth of an inch); lamellæ thin, equal, about fifty-one, descending straight into the deep part of the terminal star, and then abruptly twisted spirally about an imaginary axis, forming a prominent conical centre about one-third the diameter of the cup, and as high as its base is wide.

This highly typical species of Mr. Dana's American genus *Clisiophyllum* is closely allied to the *Cyathophyllum coniseptum* of Count Keyserling's 'Wissenschaftliche Beobachtungen auf einer Reise in das Petschora-Land,' from which it is distinguished by the strong twisting of the plates about the central cone, and by having little more than half the number of lamellæ at the same diameter. Viewing with Mr. Dana the conical arrangement of the septa as a generic instead of a specific character, it seems probable that the two varieties given by Count Keyserling of his *Cyath. coniseptum* are really two species; and the present species, though presenting some intermediate characters, is I think distinct; if hereafter any one should think otherwise, they still could hardly object to the name I have proposed in honour of so enterprising a geologist, the more so as the term *coniseptum* would not be applicable as a specific name in the genus *Clisiophyllum*, where all have the conical arrangement of septa alluded to; there can however, I think, be little doubt of the distinctness of the species. In the transverse section the central area seems a confused, close crumpling of vesicular plates occupying rather more than one-third the whole diameter, and from it to the circumference the strong, equal, rather distant plates radiate. The external vertical striæ are double the number of the actual radiating lamellæ.

Rare in the carboniferous limestone of Derbyshire.

(Col. University of Cambridge.)

Clisiophyllum bipartitum (M'Coy).

Sp. Char. Very elongate-conic, nearly cylindrical, with a diameter of $1\frac{1}{4}$ inch for the greater part of its length; strongly and regularly striated externally (about five striæ in one-fourth of an inch); external striæ corresponding in number to the radiating lamellæ: in the *transverse rough section* the central area is rather less than one-third the whole diameter, composed of the edges of confusedly blended vesicular plates, crossed by

a few faint extensions of the radiating lamellæ, and divided into two symmetrical portions by a strong median fissure; the space between this inner area and the outer wall is regularly radiated with from sixty-three to sixty-nine equal, thin, rather distant lamellæ connected by numerous delicate, transverse, vesicular plates; *terminal cup* deep, lined by the vertical lamellæ, and having a large oval prominent boss in the centre traversed by a sharp mesial crest; about one-half or one-third of the radiating lamellæ ascend the central boss, always in a direct line, those at the sides of the mesial crest being at right angles to it, the others joining at a more acute angle as they approach the extremity, and opposite one end of the crest we generally observe one or two of the radiating lamellæ shorter than the rest, producing a sort of siphon-like irregularity such as we see in *Caninia*: *vertical section* indistinctly triareal; outer area defined, about one-sixth of the width on each side, composed of small, much-curved, vesicular plates, forming small semicircular cells arranged in very oblique rows upwards and outwards, about seven in a row; inner zone about equaling the outer one in width, passing gradually into the central structure, formed of slightly larger and less curved vesicular plates than the outer zone, and having a nearly horizontal direction; central area composed of large, thin, close, little-curved, vesicular plates, forming a strongly arched series of narrow, elongate cells, the convexity of the arch upwards, conforming to the shape of the central boss in the cup; if the vertical section be at right angles to the medial fissure or crest of the central boss, there is a line visible down the middle of the section.

This coral is interesting to the physiologist from the combination of the bipartite or symmetrical with the radiated type of structure, as in some *Fungia*, &c. It nearly equals the *Caninia gigantea* (Mich.) in size and cylindrical form, but is easily distinguished by the strong longitudinal striæ of the surface, the want of transverse septa in the central area, &c.

Rather common in the carboniferous limestone of Derbyshire. (Col. University of Cambridge.)

Clisiophyllum prolapsum (M'Coy).

Sp. Char. Elongate-conic, much curved and twisted on its axis, *terminal cell* oblique, deep, with steep sides, a narrow flattened or concave space at bottom, from which protrudes the central boss, which is about one-third the diameter of the cup, nearly as high as wide, cylindrical, obtusely rounded above, and with a deep umbilical cavity in the middle (in partially decomposed or weathered specimens a rough vertical fracture frequently

shows the central area as a thick, smooth, persistent tube) ; diameter of the adult little more than an inch, and which it attains at two inches long, remaining nearly cylindrical after that length; *surface* closely striated longitudinally, about fifteen striæ in one-fourth of an inch, corresponding in number with the radiating lamellæ: *horizontal section*, inner area rather more than one-third the diameter, of small, closely blended, vesicular plates; outer area with 180 radiating lamellæ, ninety of which reach from the wall to the edge of the inner area, and ninety intermediate ones only reach half way; intermediate transverse vesicular plates very delicate: *vertical section*, inner area defined by rather thick walls; it consists of minute, compressed, elongate cells, arranged in transverse curved rows, the convexity of the curve upwards; outer area, large cellular structure, inclining upwards and outwards.

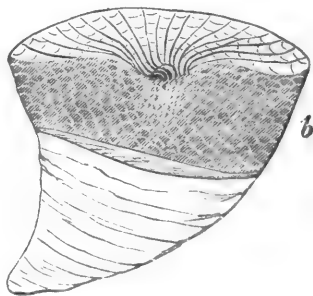
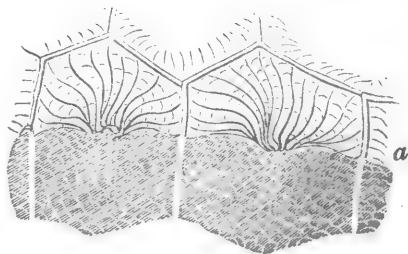
Rather common in the carboniferous limestone of Derbyshire. (Col. University of Cambridge.)

Strephodes (M'Coy), n. g.

Etym. στρέφω, *torqueo* (from the twisting of the lamellæ about the centre).

(*Strombodes* pars of Lonsdale, not of Schweigger.)

Gen. Char. Corallum simple and conic, or compound and forming rounded masses of inseparably united polygonal cells; in either case the terminal cup is deep with numerous equal, radiating lamellæ, converging from the walls to the centre, where they meet and are complicated, usually twisted in bundles about an imaginary axis: *vertical section*, small vesicular structure, the rows of cells arranged in a semielliptical curve, convexity downwards, descending from the sides at a steep angle and rounding under the centre, where the cells are a little larger than at the sides: *horizontal*



Strephodes: a. vertical section and terminal cells of compound species; b. do. simple species.

section, radiating lamellæ meeting and complicated in the centre, connected by very thin transverse vesicular plates, and the stars of the compound species separated by thick divisional walls: *budding* in the compound species marginal, in the simple species often exhibiting periodical death and continuance of growth from the centre, giving an imbricating "ringed" appearance to the exterior.

This genus is most allied to *Cyathophyllum* and *Clisiophyllum*, all three having simply conic and compound polygonal-celled species. *Strephodes* differs from *Cyathophyllum* by the equality of the radiating lamellæ and their *meeting* in the centre both in the terminal cup and horizontal section, and in wanting the transverse diaphragms; from *Clisiophyllum*, which it resembles in the meeting of the lamellæ in the centre and the absence of horizontal diaphragms, it differs in the centre (though often slightly projecting) not being elevated into the large tent-like cone, characteristic of that genus, and in the rows of vesicular cells in the vertical section not having the reversed upward curvature which is connected with that peculiar form of cell. The simple species have been placed—I cannot imagine why—in the genus *Strombodes* of Schweigger by Mr. Lonsdale and some others (see the observations below on this latter genus). The compound species differ from *Astræa*, with which many palæontologists confound them, by the solid boundary-walls to the cells (see note on this genus below), and from *Acervularia* (Schweig., not Lonsd.) by the marginal budding and want of the central tube of that genus.

The genus *Streptoplasma* of Hall in his recent volume on the Palæontology of New York, although defined nearly in the same manner, and the name having the same meaning, applies obviously according to his specific descriptions and figures of all the species, not to the present corals, but to those known in Europe under the names *Petraia* and *Turbinolopsis*, in which the lamellæ extend directly and simply almost to the centre, only the most minute portion of the centre exhibiting in some species a trace of twisting, and there being none of the vesicular plates between the lamellæ which are so strongly developed in the present group.

Strephodes multilamellatum (M'Coy).

Sp. Char. Elongate-conic, very gradually tapering (generally about 5 inches long, with a diameter of about $1\frac{1}{2}$ inch at the termination); terminal cell oblique, oval, the short axis about one-third less than the long; surface regularly girt at about every quarter of an inch with slightly oblique, strong cup-

shaped rims of growth, concave above and produced by the successive growths from the centre leaving the prominent edges of the previous cells; weathered surface finely striated by the edges of the vertical lamellæ, of which there are about twelve in a quarter of an inch: the horizontal oval section shows the centre to be excentric, close to one of the broad sides, and formed by the twisting of the radiating lamellæ about an imaginary axis; radiating lamellæ very thin, of equal thickness, about 115 to 180 at the margin, some stopping and some uniting as they approach the centre, about which they are twisted in parcels; all the lamellæ connected throughout, at regular intervals, by minute transverse vesicular plates: internal structure exposed by horizontal and vertical sections, uniformly and minutely cellular.

The great number and closeness of the lamellæ distinguish this species from those published forms allied to it.

Rare in the lower carboniferous limestones of Arnside, Kendal, and Lisardrea, Boyle, co. Roscommon, Ireland.

(Col. University of Cambridge.)

Cyathaxonia costata (M'Coy).

Sp. Char. Elongate-conic, generally about one inch long and half an inch in diameter at the cup, which is circular and horizontal; surface irregularly wrinkled transversely, and marked longitudinally with remarkably thick, strong, sharply-defined striæ, about seven in one-fourth of an inch; central solid axis very thick (often one line in diameter), and from it twenty-six thick, wedge-like, vertical lamellæ radiate to the walls; transverse vesicular plates connecting the lamellæ exceedingly delicate; in the sections the vertical lamellæ are seen to dichotomise upwards, and the large curved plates of the loose vesicular structure incline upwards and inwards towards the axis.

This is more slender in form than the *C. mitratum* (Schlot. sp.) or *C. cornu-copiæ* (Mich.), and from which and all the other turbinated corals of the palæozoic rocks it is distinguished externally by the strong, distinct, distant longitudinal ridges; the internal characters approximate it only to the *Cyathaxonia cornu* (Mich.), from which it is distinguished by its simple, few and thick lamellæ and thick axis, as well as more turbinate form.

Rare in the carboniferous limestone of Derbyshire.

(Col. University of Cambridge.)

Cyathophyllum dianthoides (M'Coy).

Sp. Char. Corallum very proliferous, forming wide conical groups; individual cones rapidly expanding, averaging one-third (or less) longer than wide, concentrically wrinkled and with obsolete longitudinal striæ externally; *terminal cup* very deep with either a sharp or truncated edge, and containing from 96 to 100 (as it approaches one inch in diameter) very thin, crenulated radiating lamellæ, alternately longer and shorter: *vertical section* shows less than one-third the diameter on each side occupied by minute vesicular tissue, the rows of cells extending obliquely upwards and outwards; the broad middle part is occupied by close, thick, transverse diaphragms. From eight to sixteen young cones take their origin from the inner part of the margin of favourably situated parent-cups, thus forming compound masses 3 inches or more in diameter, adult cones averaging $1\frac{1}{2}$ inch long.

This is closely allied to the *C. dianthus*, Gold. (*truncatus*, Linn.), and the compound examples of *C. turbinatum* (Linn. and Gold.), but is distinguished from the first by its wide, rapidly expanding cones, and from both by the lamellæ being distinctly of two alternating sizes, much thinner and greatly more numerous.

Common in the carboniferous limestone of Arnside, Kendal. (Col. University of Cambridge.)

Cyathophyllum paracida (M'Coy).

Sp. Char. Corallum of slender cones averaging half an inch wide at mouth and $1\frac{1}{2}$ inch long (generally somewhat smaller), straight or variously bent, and sometimes irregularly coalescing so as to form loose irregular masses; three or four young cones take their origin from within the margin of the parent cell, which they smother by their growth: *internal structure*, centre occupied by broad slightly undulated transverse diaphragms, four-fifths the width of the tubes; narrow outer area occupied by thirty-two equal, narrow, radiating lamellæ, variously connected by small, curved, vesicular plates; outer surface faintly striated longitudinally.

Allied to the *C. cæspitosum* and *C. quadrigeminum* of the older rocks, but the branches are not so long and cylindrical as in the first, nor so short or laterally united as in the latter; the number of the lamellæ and character of the narrow lamelliferous zone, and the very wide, distinct transverse diaphragms will serve to discriminate even fragments of the species.

Not uncommon in the carboniferous limestone of Derbyshire. (Col. University of Cambridge.)

Cyathophyllum pseudo-vermiculare (M'Coy).

Sp. Char. Elongate, cylindrical, flexuous; surface very irregular, annulated or transversely nodular, coarsely striated longitudinally (about six striæ in one-fourth of an inch); branches averaging from half to three-fourths of an inch in diameter; small cylindrical branches project at distant irregular intervals from the sides: *internal structure*, central area rather more than half the diameter of the tube, defined, composed of flat, slightly undulated transverse septa, bearing at their circumference a series of from twenty-four to twenty-seven very short, rather distant radiating lamellæ, not reaching half-way to the centre; interval between this inner area and the walls filled with loose cellular structure, formed of small vesicular curved plates, highly inclined upwards and outwards.

This interesting coral perfectly resembles the *Cyathophyllum vermiculare* of Goldfuss in external characters, but by cutting and grinding down some specimens of the true Eifel coral of that species, I have ascertained beyond doubt (what was before suspected by Mr. Lonsdale) that it is not a true *Cyathophyllum*, but belongs to that group which I have named *Strephodes*, having the radiating lamellæ extending from the walls to the centre, and there twisted together without transverse diaphragms; it also has the curious character of the radiating lamellæ having an elliptical section, being thicker in the middle than at either end, a peculiarity which I have also noticed in a British (Devonian) specimen of the same species, though not alluded to by Mr. Lonsdale in his note on this species in the memoir of Prof. Sedgwick and Sir R. Murchison on the Devonian System. The present mountain limestone coral I have shown above to possess the true *Cyathophyllum* structure, and it is not therefore likely, after what I have stated with regard to the Devonian species, to be in future confounded with it. Externally it also bears a strong resemblance to the mountain limestone fossil which I have called *Lonsdaleia duplicata* (Mart. sp.), but that coral I have ascertained to possess the very different internal structure of *Lithostrotion* of Lonsdale (*Strombodes* of Schweigger), and it is consequently with a little care incapable of being confounded with the present fossil.

Not uncommon in the lower carboniferous limestone of Kendal; a variety also occurs in the lower carboniferous limestone of Kiltullagh, Roscommon, Ireland.

(Col. University of Cambridge.)

Diphyphyllum lateseptatum (M'Coy).

Sp. Char. Stems upwards of 8 inches long, cylindrical, about 3 lines in diameter; nearly smooth, very faintly striated lon-

gitudinally, and obsoletely wrinkled concentrically: *vertical section*, middle area occupied by slightly irregular transverse diaphragms extending across two-thirds the diameter of the tubes, about four in the vertical space of one line, their edges abruptly bent downwards; lateral areas very narrow, of equal width, the inner composed of one set of minute horizontal plates, the outer of two rows of minute, curved, vesicular plates inclining upwards and outwards.

This species differs from the *D. concinnum* (Lonsd.) of the carboniferous limestone east of the Ural chain, in the great proportional width of the transverse medial plates, which average two-thirds the diameter of the stem, or three times the width of the two outer areas of one side in the present species, but average one-third the diameter of the stem, or about equal to the two outer areas of one side in the other. The dichotomous mode of division of the stems characteristic of this group, and also the conical upward projections of the centre of the transverse lamellæ immediately under the point of fissure, were very well shown in many of the specimens.

Abundant in the carboniferous limestone near Corwen.

(Col. University of Cambridge.)

Stylastræa irregularis (M'Coy).

Sp. Char. Corallum of polygonal (five- or six-angled) tubes two lines in diameter, of such twisted and irregular upward growth that a vertical fracture frequently exposes a mixed appearance of outer walls and internal section; outer surface longitudinally striated and transversely wrinkled by waves of growth: *vertical section*, inner area broad, regularly septate by nearly straight, equal, thick transverse plates; outer area very narrow, composed of much-curved vesicular plates, forming rather open rounded cells, in rows obliquely upwards and outwards, two or three in a row: *horizontal section*, central area smooth, surrounded by about thirty slightly flexuous radiating lamellæ from the walls, fifteen of which are much shorter than the others; near the walls the radiating lamellæ are connected by few, thick, vesicular plates.

This species is remarkable for the peculiar, irregularly twisted mode of growth of the columns, which, when the rock is compact, gives the mixed character to the fracture seemingly between that of *Lithostrotion* (*Strombodes*) and *Stylastræa*. It is also remarkable for the nearly perfect transverse chambering of the central area. The small diameter of the tubes and few lamellæ easily distinguish it from the other allied species.

Forms small masses in the carboniferous limestone of Derbyshire.

(Col. University of Cambridge.)

Strombodes.

Strombodes (Schweigger, not of Lonsdale) = *Lithostrotion* (Lonsd.).

This genus is defined by Prof. Schweigger (Beobachtungen auf Naturhistorischen Reisen, &c. tab. 6) as "*Cellulæ lamellosæ, centro depresso. Stirps e conis lamellosis in strata horizontalia conjunctis. Cellula terminalis cyathiformis.*" And he makes two divisions: 1st, "*coni e centro proliferi*," for which he refers to the 'Amœnitates Academicæ' of Linnæus, vol. i. pl. at p. 312, figs. 11 and 4 (this figure however shows the origin of a *marginal bud* at one point). His 2nd group, "*coni e disco proliferi*," and the reference to the same plate, figs. 10 and 3, belong to a true *Cyathophyllum* (*C. dianthus*, Gold.); his 1st group and the reference to the figures and description in the 'Amœnitates Academicæ' must therefore be taken as the type of the genus, and seem fully to justify the reference by Goldfuss of his American *Strombodes pentagonum* to this genus, the more so when the reference in Foug't's description, above referred to, to fig. 18 of the above plate, is taken into account. A coral perfectly similar to that of Goldfuss has been also figured by Mr. Dana in 'Silliman's Journal' as an example of *Strombodes*. As therefore the notion that those compound polygonal-celled corals are the true *Strombodes* of Schweigger seems to prevail extensively, and I think justly, it only remains for me to add, that having carefully examined authentic specimens of the *S. pentagonum*, I find the cone-in-cone appearance of some of the figures to be produced by a peculiarity of weathering by which many of the vesicular plates towards the circumference of the stars have fallen out, and that the coral truly possesses all the characters so admirably elucidated by Mr. Lonsdale in the 'Geology of Russia' under the title of *Lithostrotion*, a name which it would be well now to replace by the old title *Strombodes* of Schweigger. In no case could either the definition or references of Schweigger justify the placing those Silurian and Devonian corals called *Strombodes* by Mr. Lonsdale in this genus. The following species is generically placed in accordance with this view.

Strombodes conaxis (M'Coy).

Sp. Char. Columns irregularly aggregated, averaging half an inch in width, mostly hexagonal: *axis* elliptical, formed of a series

of closely superposed conical plates, connected by a few fine vertical lamellæ: *lamelliferous zone* surrounding the axis narrow, of about forty-two alternately broad and rudimentary lamellæ, the interstitial plates of which are nearly horizontal: *outer zone* wide, formed of large arched plates, not highly inclined, and forming a loosely vesicular structure: *terminal star*, axis very prominent, oval, vertically ribbed, but not twisted, seated in a deep oval or circular cup, lined by the strong radiating lamellæ; outer zone nearly flat, oblique at the sides, faintly marked with rather distant, fine lines, representing the strong radiating lamellæ of the inner zone, continued to the boundaries of the cells, which are strong, prominent and slightly crenulated.

A vertical section shows first, the outer largely vesicular area formed of broad, curved, slightly inclined plates; between this and the inner area there is a fine vertical defining line, within which the plates of the inner zone are seen to be finer and closer than those of the outer, forming a smaller cellular structure; the rows of cells are nearly horizontal near the outer zone, but within seem gradually to bend up and become continuous with the conical cup-like plates forming the axis; those conical plates of the axis seem connected by extremely delicate, irregular, radiating plates; in a rough transverse section the axis appears as a deep conical hollow on the under side. It will thus be seen that in the remarkable cone-in-cone structure of the axis this resembles the Russian *Strombodes mammillare* and *S. astroides* (*Lithostrotion id.* of Lonsdale), from both of which it differs in the axis not being twisted in the terminal star, in the outer zone not being traversed by strong radiating lamellæ, from the former in the much less obliquity of the plates of the outer area, and from the latter by the largely cellular structure of the outer area, as well as the distinctness of all the three areas under every circumstance. In general appearance and imperfect radiation of the outer area it resembles the *S. emarciatum* and *S. floriforme* (*Lithostrotion id.* of Lonsdale), but is distinguished from the first by the rudimentary radiating lamellæ between the primary ones, and from both by the conical structure of the axis, which is formed in them of irregularly twisted vertical plates.

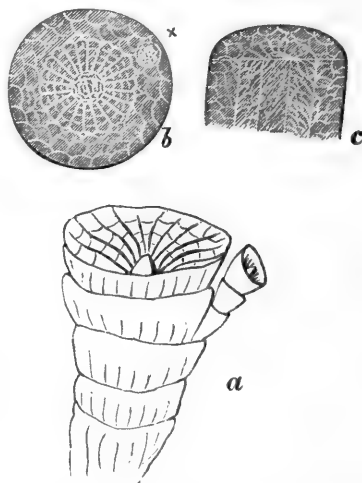
Not uncommon in the carboniferous limestone near Bakewell, Derbyshire.

(Col. University of Cambridge.)

Lonsdaleia (M'Coy), n. g.

Gen. Char. Corallum composed of circular, tapering, proliferous stems, never laterally united; internally composed of three

areas; 1st, a cylindrical, defined, complex axis composed of irregularly blended vesicular plates; 2nd, a cylindrical, defined area of strong, vertical, radiating lamellæ, connected by thin transverse dissepiments, only visible in the vertical section; 3rd, a wide, largely cellular outer zone between the vertical lamellæ and the external wall of the stem, composed of much-curved vesicular plates extending obliquely upwards and outwards: outer walls of the tubes longitudinally striated and transversely rugose: reproduction by circular germs developed in the cellular outer zone, and springing at once obliquely



Lonsdaleia: *a.* old branch exterior and terminal cups and young one growing from the side. *b.* Transverse section showing the three areas and a bud (x) growing in the outer one. *c.* Vertical section.

without the area of the parent stem, which continues its growth uninterruptedly with the slender young stem projecting from one of the transverse rugosities of the external surface; the young stem seems at first only composed of the axis, and gradually acquires the inner lamelliferous and outer vesicular zones as it increases in size.

The little-known *Erismatholites Madreporites duplicatus* of Martin's 'Petrificata Derbiensia' may be looked upon as the type of this genus, which I have dedicated to Mr. Lonsdale as a slight token of my admiration for his labours in illustrating the structure of fossil corals. It will be seen from the above notice to unite in itself the internal structure of *Strombodes* (*Lithostrotion*, Lonsd.) with the external character and mode of growth of *Cyathophyllum* (*C. dianthus*, &c.).

Lonsdaleia crassiconus (M'Coy).

Sp. Char. Corallum forming groups or loosely connected masses of elongate-conical stems, averaging 6 to 7 lines in diameter; surface with concentric wrinkles and coarse flexuous longitudinal striæ; lateral branches rapidly expanding, conical, widening from their base at the rate of 6 lines in 9 lines of length: horizontal section shows a central circular axis $1\frac{1}{2}$ line in diameter of closely twisted laminae; outside which is a circular area 3 lines in diameter, of about twenty-four vertical radiating lamellæ, with few or no connecting vesicular plates between

them ; the outer area composed of small, irregular, curved vesicular plates, forming an irregular cellulose texture : *vertical section*, the central axis of close, spirally and conically twisted laminæ ; inner area of one row of distant, delicate, irregular, curved transverse plates forming very open cells ; outer area defined from the inner, formed of loose irregular cellular tissue, of large, slightly-curved vesicular plates, extending obliquely upwards and outwards.

This species is much less irregularly wrinkled than the *L. duplicata* (Mart. sp.), forms shorter and more widely turbinated masses, and is distinguished externally at a glance by the lateral branches expanding rapidly from their point of attachment to a conical form, while in the *L. duplicata* the lateral branches retain their original small diameter for a great length (increasing at about the rate of 4 lines in 3 inches), and present a strange contrast to the parent stem, as is faithfully shown in the rough figure of Martin.

In the red carboniferous limestone of Arnside, Kendal ; also near Bakewell, Derbyshire, in the limestone of the same age.

(Col. University of Cambridge.)

Lonsdaleia rugosa (McCoy).

Sp. Char. Branches 6 or 7 lines in diameter, elongate-conic, exceedingly rugose with large transverse irregular undulations and funnel-shaped irregularities of growth, crossed by coarse, obtuse longitudinal striæ (four in the space of 2 lines) ; young lateral branches small, continuing very slender for a considerable length ; terminal cups deep, with a prominent compressed axis in the centre, middle portion with strong radiating lamellæ, which, as they approach the margin, become fainter and united into a network by strong interstitial vesicular plates : *horizontal section*, central axis 2 lines wide, of close, fine, complicated laminæ, crossed by one thick mesial plate ; axis surrounded by an area 5 lines wide, of about forty-two equal radiating lamellæ, with very few and delicate transverse vesicular plates ; outer area partially radiated by delicate prolongations of the radiating lamellæ, with numerous strong curved vesicular plates : *vertical section* shows a thick solid line indicating the *centre* of the axis (and corresponding to the mesial line through the axis of the cross section), from which the delicate, thin, close, complicated laminæ of the axis diverge downwards, but *pass gradually* into the larger and more horizontal cellular tissue of the second area ; this latter is separated by a definite line from the outer area, which is of smaller cellular tissue, composed of small, curved, vesicular plates extending obliquely upwards and outwards.

In general appearance this resembles the *L. duplicata* (Mart. sp.), but is much more rugose, and the young branches expand more rapidly; in the vertical section it is distinguished by the central line and the undefined sides of the axis, as well as the very much smaller size of the cells of the vesicular structure, and the much greater number of the radiating lamellæ, which do not exceed twenty-four or twenty-six in that species. There is a slight external resemblance between this coral and the *Cyathophyllum pseudo-vermiculare* (M'Coy), but the prominent axis easily distinguishes it.

Common in the carboniferous limestone of Corwen.

(Col. University of Cambridge.)

Lonsdaleia ? stylastræiformis (M'Coy).

Sp. Char. Corallum composed of easily separable (four- to six-sided) prismatic tubes from 3 to 5 lines in diameter; outer walls faintly striated longitudinally, and marked with arched, transverse, imbricating rugosities: *vertical section*, axis large, defined, composed of irregular, spirally complicated lamellæ; inner area of little-curved, vesicular plates, inclining obliquely upwards and outwards, each plate generally extending from the axis to the circumference of the inner zone, so that there is but one, or occasionally two lengthened cells in a row between those points; outer area narrow, composed of slightly arched plates inclining obliquely upwards and outwards, each plate usually reaching from the inner zone to the outer wall; more rarely a second arched plate is required, so that generally there is but a single row of long cells between the inner zone and outer wall, with occasionally a small irregular cell towards the margin: *transverse polished section* showing a large oval or circular, irregularly reticulated or cellular axis, from which twenty-five lamellæ of equal length and thickness radiate almost to the outer walls, the cellular lining of the walls free of radiating lamellæ being very narrow, and forming apparently a single row of irregular cells; the spaces between the radiating lamellæ crossed by very thin arched plates: *transverse rough fracture* generally cup-like above, the outer zone forming an oblique, nearly uniform margin, faintly undulated in a radiating direction, within which is the rough flat fracture of the inner zone and axis; on the under side the position of those parts is reversed, the inner area being prominent and surrounded by a narrow, radiated border sloping to the walls.

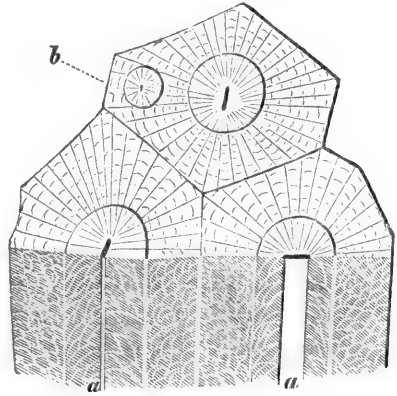
This coral is very remarkable for uniting in itself the internal structure of *Strombodes* (*Lithostrotion*, Lonsd.) with the external form and easily-separable columns of the *Stylastræa* of the same

writer. I am unable to afford any information on what would under the circumstances be the most interesting point, namely the mode of production of new columns: taking all the circumstances into consideration, I suspect the mode of increase was similar to that I have described in *Lonsdaleia* generally, the external prismatic form (which is of itself of no value) being produced by the pressure of a closer mode of growth than in the *L. duplicata*. As it is impossible to conceive a *Strombodes* (or *Lithostrotion*) splitting into easily-separable columns, I provisionally therefore place it in *Lonsdaleia*.

Rare in the carboniferous limestone of Kendal.
(Col. University of Cambridge.)

Nemaphyllum (M'Coy), n. g.

Gen. Char. Corallum composed of numerous inseparably united, polygonal, prismatic tubes, each having a straight, thin, flat, fillet-like solid, or nearly solid, axis, from which, in the *horizontal section*, the fine numerous radiating lamellæ are seen extending directly to the walls; radiating lamellæ connected by very fine transverse dissepiments only visible externally in the outer area: *vertical section* shows three distinct areas; 1st, the thin flat axis; 2nd, a sharply defined cylinder of very minutely vesicular arched plates, the rows directed from the axis obliquely downwards and outwards; outside this is the 3rd area of similar small arched plates forming a minutely vesicular structure slightly smaller than that of the inner zone, but the rows directed obliquely upwards and outwards: *reproduction* by small circular buds developed within the area of the parent star.



Section and terminal stars of *Nemaphyllum*: a a. axes; b. young bud within the area of the parent.

In mode of reproduction and tri-areal structure this genus approaches *Strombodes* (as above understood), from which it differs altogether in the nature of the axis, which in all the species of that genus is cylindrical, composed of numerous plates variously twisted together, and giving a cellulose section in every direction; the axis of the present group on the contrary forms a thin, flat, simply solid lamina, and is exhibited in a vertical fracture either as a narrow opaque white line, or as a broad ribbon-like fillet, according to whether the section is in the direction of its width or

across it; a further difference is constantly observable between those groups in the vertical section, which is, that the interstitial vesicular plates of the inner area in *Strombodes* have their rows either nearly horizontal or inclining obliquely upwards from the axis towards the outer wall, while in *Nemaphyllum* on the contrary they converge towards the axis above and incline downwards and outwards below, so as to meet at a considerable angle those of the outer area which incline in the usual direction upwards and outwards towards the walls; this peculiarity in the inclination of the interstitial vesicular plates of the inner area produces a marked difference in the stars on the weathered surface in the two genera, causing the inner area to form a large prominent oval or conical boss in *Nemaphyllum*, and a flat or deeply hollowed cup in *Strombodes*. A third difference between those generic groups is, that in the latter the vertical radiating lamellæ are principally confined to the inner area, not existing in most of the species at all in the outer area, and do not reach the walls, while on the contrary all the radiating lamellæ in *Nemaphyllum* arise from the outer walls, are strongest in the outer area, and only half of them in general penetrate the inner area. In the latter corals also the whole vesicular structure is much more minute and delicate in stems of the same size than in the others, and the cells of the inner area are larger than those of the outer, which is the reverse of what we find in *Strombodes*. As the young columns are produced from circular buds continuing their development *within* the walls of the parent, it results that the stems are inseparably united; the walls defining the stars being one simple plate, the joint production of the adjacent polypes, cannot be divided, and consequently vertical fractures of the mass, instead of exposing the flat, striated external surface of the stems, pass invariably through the substance of the coral itself, exposing only sections of the interior; the external walls being only seen in those rare cases showing the extreme limits of a mass, or where in a section two masses may have coalesced. Some of the species resemble *Clisiophyllum*, but are distinguished by the peculiar axis and by the cells of the inner area being larger and fewer than those of the outer. The genus is I believe exclusively palæozoic.

Nemaphyllum arachnoideum (M'Coy).

Sp. Char. Stars with from four to seven angles, and averaging from 6 to 9 lines in diameter; axis very thin, 1 line wide: *vertical section*, inner vesicular area wider than the outer, of little-arched plates inclining slightly downwards from the axis; it takes about two of those plates to reach from the axis to the extent of this area, or two irregularly elongate unequal cells

in an oblique line from the axis to the wall of the inner area ; outer area separated from the inner by a sharp distinct line on each side, and composed of much smaller and more highly curved vesicular plates, so that there are from five to seven small, nearly equal, rounded cells extending in a line obliquely upwards and outwards from the inner area to the outer walls of the tube : *horizontal section*, boundary or divisional walls thin, stars radiated with from fifty to fifty-five very thin lamellæ, of equal thickness, but alternately long and short, the long reaching to the centre, the short barely entering the edge of the inner area : *weathered surface*, stars flattened, separated by a depressed line ; inner area forming a gently convex oval or circular boss, with the axis forming a short impressed line in the middle ; the radiating lamellæ exhibit numerous delicate curved interstitial plates in the outer area, but none in the inner area.

This beautifully delicate species is the largest of the genus I am acquainted with, the usual width of the stars being about 7 lines, diameter of the inner area about $2\frac{1}{2}$ lines. It very frequently exhibits the young oval buds within the corners of the old stars, generally but one, very rarely two in a star.

Forms large masses in the carboniferous limestone of Derbyshire.

(Col. University of Cambridge.)

Nemaphyllum minus (M'Coy).

Sp. Char. Stars having from four to seven angles and averaging from 3 to 4 lines in diameter ; axis thin, about $\frac{3}{4}$ ths of a line wide : *vertical section*, inner area slightly wider than the outer on each side, composed of slightly curved vesicular plates extending obliquely downwards and outwards, each one nearly reaching from the axis to the external boundary of the inner area, forming thus but one or two cells in each oblique row between those points ; outer area of smaller and more curved plates, forming smaller, more regular and rounded cells disposed in indistinct rows obliquely upwards and outwards, about four in a row from the inner area to the outer wall : *weathered surface*, stars nearly flat, separated by impressed lines, inner area forming a large convex oval or circular boss in the middle of the star and having the axis in the centre ; radiating lamellæ forty-five, thin, of equal thickness, one-half of them reaching the centre, the intermediate ones entering but a short way into the inner zone ; numerous small, curved, interstitial plates between the lamellæ in the outer zone, not visible in the inner one.

This species is allied to the *N. arachnoideum* (M'Coy), but is

constantly distinguished by the smaller size of the stars, fewer radiating lamellæ, and more open internal vesicular structure.

Forms large masses in the carboniferous limestone of Kendal. (Col. University of Cambridge.)

Nemaphyllum decipiens (M'Coy).

Sp. Char. Weathered surface having the stars undefined, the lamellæ of the outer area of adjoining cells appearing continuous, and forming a flat surface, in which the inner area of each star forms a deep cylindrical cell $1\frac{1}{2}$ line in diameter, and about their own diameter apart; in the bottom of those cells the lamellæ rise to form a little cone, from the apex of which projects (when well-preserved) the long thin flat axis, rising to the level of the outer area; on the polished *transverse section* the stars are perfectly defined by distinct walls four- to six-angled, 2 to 3 lines in diameter, with a flat central axis half a line wide, and show the circular germs of young columns in the corners of some of the old stars; radiating lamellæ thin, about thirty-four, of equal thickness, one half reaching the centre, the other barely touching the inner area, which forms a circle about $1\frac{1}{2}$ line in diameter; the radiating plates are connected by numerous curved vesicular plates in the outer area, but few or none are visible in the inner area: *vertical section*, axis thin, solid; inner area of small, curved, vesicular plates extending obliquely downwards and outwards from the axis, about two or three cells in a row; outer area separated from the inner by a thin vertical line, it is composed of small curved vesicular plates, in rows inclining obliquely upwards and outwards, about four cells in a row.

The flat broad spaces between the cups, the seeming continuity of the radiating lamellæ of adjoining stars, and the apparent want of divisional walls between those latter, give the weathered surface of this coral much the aspect of the so-called *Astræa Hennahii* (Lonsd.) of the Devonian rocks; but it is clearly distinguished by the divisional walls appearing distinctly in the horizontal sections, and by the flat, nearly solid axis, which is very obvious both in the polished section and weathered stars.

Not uncommon in the carboniferous limestone of Derbyshire. (Col. University of Cambridge.)

Nemaphyllum clisioides (M'Coy).

Sp. Char. Stars generally hexagonal and averaging 2 lines in diameter: *weathered surface*, stars defined by a rather thick, prominent, crenulated divisional wall; outer area inclined downwards and inwards to form a shallow cup, in the middle of which the inner area rises into a conical tent-like boss having

the small flattened axis in the centre: *horizontal section*, divisional lines of the stars thin, straight; axis thin, half a line wide; radiating lamellæ thirty-six, thin, one half extending in a flexuous manner from the walls to the centre, the intervening ones also flexuous but of irregular lengths, most of them reaching half-way; transverse vesicular plates very few and delicate, if visible at all: *vertical section*, axis as in the other species; inner area very wide, of large, little-curved vesicular plates, inclining obliquely downwards and outwards; one or two lengthened irregular cells reach from the axis to the outer area; outer area very narrow, of small, much-curved vesicular plates inclining very obliquely upwards and outwards, forming minute rounded cells about two in a row.

This species much resembles some of the massive Astræoid *Clisiophylliæ* of Dana by the conical tent-like aspect of the inner area within the cups or weathered terminal cells; the distinct flattened axis, resembling that of the other *Nemaphylliæ*, will however distinguish it. The flexuous character of the radiating lamellæ in the transverse polished section is remarkable. The *Astræa irregularis* of Portlock's 'Report on Londonderry,' &c which I know to be a true *Nemaphyllum*, resembles this species in the small size of the stars and flexuous lamellæ, but is easily distinguished by the cells being simply cup-shaped, descending uninterruptedly from the walls to the small, flat, prominent axis in the bottom of the cup, instead of the large tent-like boss formed by the inner zone of the above.

Forms irregular tuberoso masses in the carboniferous limestone of Derbyshire.

(Col. University of Cambridge.)

Nemaphyllum septosum (M'Coy).

Sp. Char. Corallum of long, inseparable, slightly diverging five- or six-angled tubes, with an average diameter of 5 lines: *vertical section*, axis straight, thin, flat, three-fourths of a line wide; inner area composed of large, rather distant, slightly arched plates, each of which generally extends across the entire area, so that one lengthened cell (rarely more) reaches from one side to the other of this area, having the axis in the middle; outer area broad, of numerous minute, much-arched vesicular plates inclining obliquely upwards and outwards, about four of the little cells in the oblique line from the inner area to the outer wall: *transverse rough fracture* showing the inner area to be composed of slightly conical or cup-shaped plates, their diameter equal to that of the area, and pierced in the centre by the flat persistent axis: *polished transverse sec-*

tion, radiating lamellæ forty-eight, thin, twenty-four of which reach the centre, while the intervening ones are nearly marginal, not reaching half-way to the inner zone; interlamellar vesicular plates very numerous and delicate in the outer zone, apparently absent in the inner zone.

This species has some affinity with the *N. minus* (M'Coy), but is constantly distinguished by the open, simple, subseptate character of the inner zone in the vertical section, the extreme comparative shortness of the alternate lamellæ in the transverse section, and the peculiar character of the broad, simple, cup-like plates of the inner zone in the rough transverse fracture.

Very common in the carboniferous limestone of Tullyard, Armagh, Ireland.

(Col. University of Cambridge.)

[To be continued.]

II.—*Note on the Colour of a Freshwater Loch.* By GEORGE DICKIE, M.D., Lecturer on Zoology and Botany in the University and King's College of Aberdeen*.

VARIOUS vegetable productions have on different occasions been recorded as having appeared in such profusion that they communicated a colour of greater or less intensity to bodies of fresh water in which they naturally live. The plants in question belong to the *Oscillatorieæ* and *Nostochineæ*; among the former, *Oscillatoria ærugescens* has been recorded by Dr. Drummond (Ann. Nat. Hist. vol. i. 1st Series) as giving a tinge to the water of Glaslough in Ireland†; I have found the same species at Aberdeen, and particularly abundant in a small and shallow artificial lake, in sheets of great extent at the bottom. I have not observed it, as stated by Dr. Drummond, "broken into innumerable fragments, and suspended like cloudy flocculi in the water;" it sometimes however becomes detached from the bottom and forms large masses on the surface. The following plants belonging to the *Nostochineæ* have been described by Mr. Thompson of Belfast as producing the same effect: the *Anabaina spiralis* (*Spirillum Thompsoni*, Hass.) was observed to colour Ballydrain Lake in the county of Antrim; *Anabaina Flos-aquæ*, Bory, he saw "tinging with its delicate green hue the margin of the smallest of the Lochs Maben in Dumfries-shire," and *Aphanizomenon incurvum*, Morren, was "observed on the surface of sheltered creeks in Ballydrain Lake."

* Read before the Botanical Society of Edinburgh, Nov. 9, 1848.

† *Oscillatoria rubescens* has been observed to communicate a red tint to Lake Morat in Switzerland.

Professor Allman has more recently described (Annals of Natural History, vol. xi.) a new plant, *Trichormus incurvus*, All., as "colouring the water of the Grand Canal Docks near Dublin, a pea-green."

The present brief notice is for the purpose of recording the occurrence of a species of *Rivularia* near Aberdeen, under circumstances similar to those of the plants alluded to and producing a like effect. For some years back excursions have been made with the students of my botanical class to a loch on the estate of Parkhill, about four miles north-west from Aberdeen. The sheet of water in question is about a quarter of a mile in its greatest length; on almost all sides it is surrounded by extensive deposits of peat, with the soluble matter of which a great proportion of the water passing into the loch is impregnated. The loch abounds in *Scirpus lacustris*, *Arundo Phragmites*, *Nuphar lutea*, *Nymphæa alba*, and various species of *Potamogeton*, &c. The locality was generally visited in the beginning of July; nothing peculiar had ever been observed till the summer of 1846, when my attention was arrested by a peculiar appearance of the water, especially near the edge, but extending also some distance into the loch. Numerous minute bodies with a spherical outline, and varying in size from $\frac{1}{24}$ th to $\frac{1}{12}$ th of an inch in diameter, were seen floating at different depths, and giving the water a peculiar appearance. In some places they were very densely congregated, especially in small creeks at the edge of the loch. A quantity was collected by filtration through a piece of cloth, and on examination by the microscope, there could be no doubt that the production was of a vegetable nature and a species of *Rivularia*; one however unknown to me, and not agreeing with the description of any species described in works to which I had access. Specimens were sent to the Rev. M. J. Berkeley; he informed me that the plant belonged to the genus mentioned, and stated it to be *Rivularia echinulata*, E. B. Along with it, but in very small quantity, I also found another plant, the *Anabaina Flos-aquæ*, Bory.

In the first week of July 1847, the same species were observed similarly associated, but the *Anabaina* was now more plentiful, without however any apparent corresponding diminution in the quantity of the *Rivularia*.

In July last (1848) it was observed that the *Rivularia* was as rare as the *Anabaina* had been in 1846; to the latter consequently the water of the loch now owed its colour, which was a very dull green; the colour however becomes brighter when the plant is dried. In neither of the seasons mentioned was it in my power to make any observations on the colour of the loch earlier or later than the date above-mentioned, consequently nothing can

be added respecting the comparative development and progress of the two plants at other seasons.

Two other smaller lochs in the same vicinity were not observed to present any appearance of the productions in question.

In connection with the subject of this short notice, it may be stated, that during a visit to Ben Muich Dhu in 1846, the appearance presented by a patch of snow at 3500 feet of elevation, attracted attention. It seemed as if sprinkled over with soot; a quantity of the black matter was collected, and found to consist in part of the following *Diatomaceæ*: *Eunotia triodon*, *Navicula viridula*?, *N. curvula*?, and *Meridion circulare*, and along with them *Protococcus nivalis* in very small proportion; the remainder consisted of inorganic matter, the nature of which was not ascertained.

III.—*Stirpes Cryptogamæ Sarnienses; or Contributions towards the Cryptogamic Flora of Guernsey.* By the Rev. T. SALWEY, Oswestry*.

So much has been done by Mr. Babington in his 'Primitiæ Floræ Sarnicæ' for the illustration of the phænogamous flora of the Channel Islands, that perhaps a brief notice of the cryptogamic botany of one of the islands of this group may be acceptable to some of the Members of the Botanical Society. Guernsey does not appear to be very prolific in cryptogamic plants—a variety of causes tend to produce this result—the open nature of the country; the great paucity of wood; the general dryness of the soil from the circumstance of all the rocks being of the primitive formation; and the very great proportion of the land being under the cultivation either of the spade or plough; all these circumstances are inimical to the growth and perfect development of cryptogamic plants. There are no woods in the island, and the soil even of the orchards is in general under the culture of the spade. It is at once evident therefore that the great variety of Agarics, Boleti, and the innumerable other Fungi which are found so abundantly in the extensive woods and rich pastures of England, have no corresponding habitats here in which to grow. The same reason limits the number of Musci, Hepaticæ and Jungermannia, whilst from the few brooks and ponds which are found in the island it is equally hopeless to expect a great number of freshwater Algæ. Even the lichens do not exhibit that luxuriance of growth which we find in the deep woods and glens of the Cambrian mountains. Thus the common *Parmelia saxatilis* is seldom found here in fruit, and the few

* Read before the Botanical Society of Edinburgh, Nov. 9th, 1848.

meagre specimens of *Sticta pulmonaria* are also without apothecia. The abundance of their orchards led me to expect that I should discover here the *Parmelia chrysophthalma* which is found in the south of England; but my researches failed in discovering more than a single specimen of this plant in an orchard in Sark. My friend Mr. Lukis some years ago once found also a single specimen of the same plant in the northern part of Guernsey. This island however possesses much to interest the lichenist from more northern regions. He will find here abundance of the *Roccella tinctoria*, and will also meet with *Lecanora milvina*, *Lecidea Salveii*, *Parmelia leucomelas*, *Sticta aurata*, and *Porina pustulata* of Ach.,—a plant hitherto a stranger to our British flora.

In the minute epiphyllous fungi the island is more prolific than I have found any locality of the same extent in England—some few species are in extreme abundance and very fine, as the *Puccinia Cotyledonis* and *Æcidium Bunii*—the *Dothidea rubra* also is much more highly developed than I ever found it in England, thus showing the influence of a southern climate on this class of plants. There was one circumstance however with respect to this tribe of plants which much struck me. In Shropshire and Herefordshire, as well as in Wales, it is perhaps not possible to find a sycamore-tree of which the leaves are not blackened with numerous specimens of the *Rhytisma acerinum*; whilst in Guernsey I could not even detect a single specimen, although I examined every tree I met with after my attention was attracted by this circumstance. The leaves of every sycamore-tree in the island are as perfectly free from this discolouring epiphyte as those of the plane-tree. One or two of the Uredines which I have sent to Mr. Berkeley he thinks may prove to be new species. Amongst this tribe of plants he has already named as new the *Depazea Caricæ* on the leaves of the common fig-tree, and the *Ustilago Salveii* on young plants of *Dactylon glomeratus*.

The richest part of the cryptogamic flora of Guernsey will doubtless be found in the marine Algæ. Were any one well acquainted with this department of botany to be long resident here, I feel little doubt that some interesting discoveries might be made. The few opportunities I have had of studying them from short and occasional visits to the sea-coast, and this in only one or two localities, have given me little opportunity of becoming much acquainted with this branch of botany; whilst during the time of my residence in this island, the state of my health confined me so much to the house, that my botanical researches in every branch were greatly interrupted. The list therefore which I have sent you is only to be considered as “contributions” towards the cryptogamic flora of Guernsey, of which it is

hoped that some native of the island will be induced to give us a more complete account, for what a stranger is enabled to discover in a brief visit can only be a small portion of the botanical treasures of the island.

I feel that I cannot conclude this short notice without expressing my best thanks to my friends Messrs. Borrer, Berkeley, Ralfe and Wilson for kindly naming such specimens as I was in doubt about.

List of Guernsey Cryptogamic Plants, with a few notices upon some of them.

Musci.

- Phascum crispum* ; β . *rostellatum*.
subulatum.
Pottia Heimii. Rocks in the parish
of St. Peter du Bois on the coast.
{ *Gymnostomum fasciculare*, *Hook.*
and *Tay.* in part (*Wilson*).
Physcomitrium ericetorum, *Bruch*
and *Schimper*, var. (*Wilson*).
Gymnostomum pyriforme.
microstomum.
Weissia fugax. In a cave at Petit Bo.
controversa.
Grimmia pulvinata.
maritima.
Ceratodon purpureus.
Trichostomum canescens.
Dicranum bryoides.
adiantoides.
taxifolium.
squarrosum.
flexuosum.
scoparium.
heteromallum.
Campelopus densus. Jerbourg.
Tortula muralis.
ruralis ; β . *lævipila*.
aloides.
Polytrichum commune.
juniperinum.
aloides.
Entosthodon Templetoni. Road lead-
ing down to Petit Bo from the
east.
Funaria hygrometrica.
Orthotrichum diaphanum. Catêl

Hepaticæ.

- | | |
|-------------------------|---------------------------|
| Riccia crystallina. . . | Marchantia hemisphaerica. |
| lamellosa. | Jungermannia bicuspidata. |
| Anthoceros punctatus. . | pusilla. |
| Marchantia polymorpha. | albicans. |

Jungermannia complanata.
polyanthos.
viticulosa.
bidentata.
heterophylla.
serpyllifolia.

Jungermannia dilatata.
tamarisci.
β. monilensis.
epiphylla.
furcata.

Lichenes.

Usnea plicata.
Evernia flavicans.
Ramalina calicaris.
α. fraxinea.
β. fastigiata.

Ramalina pollinaria.
polymorpha.
scopulorum.
Roccella tinctoria.
fuciformis.

I cannot agree with the authors who unite these two plants. If intermediate states are to be considered as a sufficient ground for uniting what have hitherto been considered distinct species, then must a great many more of the *Cladonia* be united than is now done, for between the greater part of the different species in this genus there are so many intermediate states, that it is extremely difficult to know to what species to refer many specimens. Manufacturers have noticed that the *tinctoria* is very superior as a dye to the *fuciformis*, and my friend Mr. Lukis has pointed out to me a distinction between these two plants which I was not before aware of, but which the examination of a great number of specimens enabled me to confirm; viz. that the *sap* of *tinctoria* is of a deep yellow, staining the fingers when gathered, whereas that of the *fuciformis* is not so. It is perhaps to be regretted that chemical tests have not been resorted to in endeavouring to distinguish between nearly allied plants.

Cetraria sepincola.
Peltigera resupinata.
β. parilis.
canina.
β. pusilla; spuria, Ach.
rufescens.
polydactyla.
Sticta aurata. Jerbourg, *Mr. Lukis;*
on the rocks N. of the Eperquerie,
Sark, *T. S.*
Sticta fuliginosa.
limbata.
scrobiculata.
pulmonaria.
glomulifera.
herbacea.
Parmelia perforata.
perlata.
tiliacea.
Borreri.
saxatilis.
β. omphalodes.
γ. sulcata, Fl. Hib.
physodes.

Parmelia olivacea.
caperata.
rugosa, Fl. Hib.
conspersa.
parietina.
ι. concolor; candelaria,
Ach.
lævigata, Ach. & E. B.
scorteia, do.
chrysophthalma. In an or-
chard at Sark.
leucomela. Jerbourg and
S.W. point of Rocquaine
Bay, *Mr. Lukis.*
ciliaris.
aquila.
pulverulenta.
speciosa.
stellaris.
β. hispida; Lichen tenel-
lus, E. B.
erosa, Suppl. to E. Bot.
2807.

There are two varieties (unless indeed they are distinct species) of this plant in Guernsey. In the one the thallus exhibits the same loose mode of growth that it does with us in England and Wales, but has no sorediæ; but in the other it adheres so closely either to the rock or tree on which it grows that it is very difficult to detach the specimen. The *surface* too of this latter var.?, and not the edges, is copiously sprinkled with sorediæ. In the description given of the *erosa* in the 'Suppl. to E. B.' it is observed, "that sometimes the edges are raised, and producing mealy granules on the *under* side, assume, although not hollow, an appearance approaching to that common in *P. tenella*." The sorediæ however of the Guernsey var. of this plant are on the *upper* surface of the thallus. The hue of the thallus too, which is of a very pale whitish green, and its being more frequently found investing the dark crevices of rocks than growing on trees, seems to point out a difference of species. The shields also of the former variety are decidedly black, whilst those of the latter, though very minute in my specimens, are of a brown colour. The former variety I have not found in fruit in Guernsey.

Parmelia obscura.

- a. cyclozelis.*
- β. ulothrix.*
- plumbea.*
- lanuginosa.*
- brunnea.*
- pezizoides, Suppl. to E. B.*

Parmelia crassa.

- coarctata.*
- saxicola.*
- elegans.*
- murorum.*
- β. miniata.*

There is a very beautiful variety of this plant forming extremely thin extensive patches on the rocks of a bright orange colour. The thallus is almost wholly minutely granular, and without apothecia. To the naked eye it looks only like an orange stain upon the rock.

Parmelia fulgens. Downs near the sea on the N. of the island, *Miss Lukis.*

Parmelia circinata.

- cervina.*
- β. squamulosa.*
- tartarea.*
- carneo-lutea.* On an elm-tree in the village above Saint's Bay.
- subfusca.*
- atra.*
- cinerea.*
- badia; β. milvina.* Jerbourg.
- sophodes.*
- ? *exigua?*

leadens hue towards the edges, when dry. Apothecia hemispherical, dark brown, with a raised somewhat crenulate border of a lighter hue than the thallus. On the rocks at Dixcart Bay, Sark.

Parmelia hæmatomma.

- varia, and*
- δ. polytropa.*
- vitellina.*
- ferruginea.*
- sordida; a. glaucoma.*
- β. sulphurea.*
- impolita; Arthonia pruinosa, Ach.*
- scruposa.*

Crust cartilaginous, of a dark green colour, having somewhat of a

Gyalecta cupularis; Lichen marmoreus, E. B.
Cladonia endiviæfolia.

Cladonia alcicornis.

pyxidata.
fimbriata.
furcata.
rangiferina.
gracilis; *b. hybrida*; *cervi-*
cornis, E. B.

Bæomyces rufus, E. B.

anomalus, Fl. Hib.

Biatora atrorufa.

vernalis; *a. luteola.*

A very beautiful state of this with reddish shields which are often proliferous, and with a waved border, grows on decaying tufts of thrift in Sark.

Biatora rivulosa; *a. saxicola.*

β. corticola.

———?

Between *uliginosa* and *synothea, E. B.*

Crust dark green, consisting of innumerable very minute granules or scales, forming a spongy crust. Apothecium black, globular, finally flat, and with a pale border usually sprinkled over with the minute scales of the crust. On walls.

Biatora quernea. Barren.

lucida.

Salveii; *Lecidea, Suppl. to E. B.*

Lecidea canescens.

vesicularis.

albocærulescens; *Lecid. cæ-*
sia, Ach.

contigua; *a. disciformis.*

lapidica.

atro-alba; *ε. subconcentrica*;

Lichen concentricus, E. B.

fusco-atra.

confluens.

geographica.

premnea.

enteroleuca; *elæochroma.*

Lecidea albo-atra; *a. corticola.*

c. saxicola; *epi-*
polius, E. B.

sabuletorum; *γ. coniops.*

citrinella; *scabrosus, E. B.*

Umbilicaria pustulata. Near Petit Bo, Mr. Lukis.

Opegrapha saxatilis.

scripta.

dendritica.

Coniocarpon cinnabarinum.

Sphærophoron compressum.

Endocarpon miniatum.

pulchellum, E. B. Suppl.

2602. On some elm-trees in the lane leading from Havilland to Fermain Bay.

Sagedia fuscella.

Pertusaria communis.

fallax.

pustulata, Ach. On an ash-tree by the side of the road at Rousaitre.

Verrucaria epigæa.

muralis.

umbrina.

maura.

nitida.

epidermidis.

punctiformis.

leucocephala.

viridula.

olivacea.

acrotella, Fl. Hib.

Collema nigrum.

crispum.

cristatum.

lacerum.

subtile.

muscicolum.

plicatile.

nigrescens.

ceranoides.

Characeæ.

Chara vulgaris.

Chara pulchella. Sark.

Algæ.

Cystoseira granulata.

fibrosa.

Halidrys siliquosa.

Fucus vesiculosus.

serratus.

nodosus.

canaliculatus.

Himanthalia lorea.

Lichina pygmæa.

Alaria esculenta.

Laminaria digitata.

saccharina.

Chordaria flagelliformis.

Chorda filum; *β. thrix.*

Dictyota dichotoma.

Furcellaria fastigiata.

Delesseria ruscifolia.
Rhodomenia bifida.
 laciniata.
 jubata.
 palmata; β. sarniensis.
Plocamium coccineum.
Rhodomela subfusca.
Laurencia tenuissima.
Chylocladia ovalis.
 articulata.
Gigartina purpurascens.
Chondrus crispus.
Gelidium corneum.
Dumontia filiformis.
Porphyra vulgaris.
Ulva lactuca.
 linza.
 crispa.
Enteromorpha intestinalis.
Bangia fuscopurpurea. Scarce.
Codium tomentosum.
Vaucheria velutina.
 sessilis.
Cladostephus verticillatus.
 spongiosus.
 • *Sphacelaria scoparia.*
 olivacea. In a cave near
 the gentlemen's bath-
 ing-place.
Ectocarpus littoralis.
 siliculosus.
 tomentosus. Grand Cobo.
Polysiphonia fastigiata.
 thuyoides.
 urceolata.
 byssoides.
 fruticulosa.
Dasya coccinea.
Ceramium rubrum.
 ciliatum.
Griffithsia equisetifolia.

Griffithsia setacea. Fermain Bay.
 corallina. Bay under the
 Artillery Barracks.
Calithamnion polyspermum.
 tetragonum.
 Rothii.
Conferva Linum. St. Sampson's.
 ærea.
 fucicola.
 rupestris.
 glaucescens.
 arcta.
 flexuosa.
Zygnema nitidum.
 quininum.
Scytonema myochrus. This forms a
 velvety stratum upon a bank near
 the sea at Jerbourg. It is of a
 deep indigo colour.
Lingbya muralis.
Oscillatoria nigra.
Chroolepus aureus.
 Iolithus.
Trentepohlia purpurea. In a cave
 beyond the bathing-place.
Corynephora marina.
Palmella botryoides.
 cruenta.
Nostoc commune.
 verrucosum. In a small ri-
 vulet in Saint's Bay.
Rivularia atra. Grand Havre.
Meloseira nummuloides. Brook in
 the N. of the island.
Fragilaria pectinalis. In a well at
 St. Andrew's.
Diatoma fenestratum. Ditto.
 flocculosum. Ditches near
 Ivy Castle.
Gomphonema ampullaceum. In a
 well at St. Andrew's.

Fungi.

Agaricus procerus.
 muscarius.
 coccineus.
 campestris.
 Georgii. St. Martin's; sold
 in the market.
 orcadæ.
 Rotula.
 caulicinalis.
Polyporus vulgaris.
 Ribis.
 ulmarius. In an elm-tree
 in the village at Saint's
 Bay.
Thelephora hirsuta.
Peziza cacaliæ. On pods of *Mathiola*
 sinuata. Portinifer.
Cryptomyces vesicolor; c. viridis.
 St. Sampson's.
Dacrymyces stillatus.
Sphæria typhina.
 graminis.
 loniceræ.
 hedericola.
 confluens. On the decaying
 trunk of an ash-tree in
 St. Andrew's parish.
 lata.

- Sphæria concentrica*.
Myriangium Duriæi, Berk. & Mont.
 On ash-trees in Sark.
Phoma asteriscus. On *Heracleum* in
 Moulin Huet Bay.
Dothidea ulmi.
rubra.
Lycoperdon gemmatum; ϵ . *furfura-*
ceum.
Scleroderma vulgare.
Erysiphe communis.
Oidium moniloides.
Aregma bulbosum.
Puccinia graminis.
polygonorum.
lychnidearum.
Cotyledonis.
violarum.
Fabæ.
prunorum.
Æcidium Bunii.
laceratum.
primulæ.
rubellum.
ranunculacearum.
Periclymeni. Fermain Bay.
Depazea Caricæ. On the leaves of
 the common fig-tree. Berk. MSS.
- Ustilago Salveii*, Berk. MSS. On
 young plants of *Dactylon glome-*
ratus. St. Martin's.
Uredo compransor.
Petrosellini. On *Sium lati-*
folium.
caricina. On *Cyperus longus*.
bifrons. On *Rumex obtusif-*
olius.
ranunculacearum.
rubigo.
cylindrospora.
polygonorum.
Rosæ.
caprearum.
leguminosarum.
candida. On *Lepidium latifo-*
lium. Grand Cobo.
primulæ.
hypericorum.
trifolii, Dec. *apiculosa*, Lk. On
Medicago denticulata.
 —. On *Lotus hispidus*.
 —. On pea leaves—not *ap-*
pendiculosa—a very hand-
 some species.
Scillarum.

IV.—On the Structure and Habits of the Orobanchaceæ.

By ARTHUR HENFREY, F.L.S.

THE discovery by Mr. Mitten of the parasitism of *Thesium*, and the extension of the same character among the Rhinanthaceæ pointed out by M. Decaisne, have given additional interest to the study of parasitical plants, and I take advantage of an opportunity I had last summer of examining our two common species of *Orobanche*, *rapum*, Thuill., and *minor*, Sutt., to call attention to some points connected with their structure and mode of growth which do not appear to have been noticed.

M. Duchartre published in the 'Ann. des Sc. nat.' Sept. 1843, an account of the anatomy of *Lathræa clandestina*, Linn., and in the 'Ann. des Sc. nat.' Aug. 1845 of *Orobanche Eryngii*, Vauch.; and in the 'Ann. des Sciences nat.' for Sept. 1847, M. Lory relates the results of his observations on the structure and physiology of *Orobanche Teucrii*, Holl et Schultz., *Galii*, Duby, *major*, L., *brachysepala*, Schultz., and *cruenta*, Bert., which, as far as they go, agree with what I have noticed in *Orobanche rapum* and *minor*.

The stems of these plants present in a cross section a very

large central cellular region or pith, composed of elongated cylindrical cells; these pass gradually, without the intervention of a medullary sheath, into the woody region composed of a number of fibro-vascular bundles arranged in a circle and forming a continuous envelope to the pith, no medullary rays existing. The wood, which is very deficient in quantity compared with the pith and cortical layer, contains spiral fibrous vessels, the turns of the spirals being sometimes in contact, at others widely separated, not unrollable, and these are surrounded by elongated cylindrical cells with conical extremities. The wood passes insensibly into the cortical parenchyma which forms a very broad region, composed of cells resembling those of the pith, and it is clothed externally by a layer of epidermis, the cells of which have the form of elongated prisms. Stomates appear to be very rare; I observed none in a number of portions of epidermis of *O. rapum* taken from all parts of the stem, but the cells were often filled with a brown resinous secretion. In *O. minor* this secretion is less abundant, and I observed a few stomates here and there. In both species the epidermis is clothed with numerous capitate glandular hairs; these consist of filaments formed of three or four cells attached end to end and gradually diminishing in diameter upward, terminated above by a globular body consisting of one, two or three cells, filled with a resinous secretion.

In full-grown specimens the lower part of the stem is enlarged into a bulbous expansion which appears to me to be a true *tuber*. It presents a central parenchymatous region, which by its enlargement forces the fibro-vascular bundles apart, so that they lie irregularly toward the periphery, beneath the cortical region continuous with that of the upper part of the stem. The vascular structures in the tuber consist, not of spiral vessels like those of the stem, but of longish cells, which from their varying direction have not been thrown into long ducts like the vessels above, by the absorption of their contiguous ends, but retain their cellular form, while the deposition of secondary layers has gone on to the conversion of the spiral into the reticulated structure.

The stem and upper part of the tuber are furnished with fleshy scales which are composed of cellular tissue, and have fibro-vascular bundles running into them from the woody zone.

The roots bear some resemblance to those of Monocotyledons. They present a central vascular region composed of about four bundles disposed so that the vessels present a cross in the transverse section, but the woody cells forming the remainder of the bundles are blended into a mass, well-defined at the circumference, where they are inclosed by the cortical layer. The vessels

of the roots arise from the bundles of the tuber and are of the reticulated kind; the cortical layer of the roots is continuous with the cortical parenchyma of the tuber.

These tubers of *Orobanche* propagate by subterraneous buds. It is well known that the plants often occur three or four adhering together, but I believe the reason has not before been shown. I found growing plants with the decayed tubers of the preceding year still adherent, and others which had completed their flowering, that had buds growing out from the base of the tuber. These buds were not axillary in appearance, for they arose quite below the lowest scales of the tuber, but it is reasonable to suppose that they had originated from the axils of scales which had decayed.

The most important point remains, viz. the mode of attachment of the parasite to the foster-plant. I have only observed this in *O. minor*; here the root of the *Trifolium* was traced into the substance of the tuber; its fibro-vascular structures become separated, and lose themselves by ramifying in the substance of the parasite. The union is completely organic, and in one specimen examined the tuber had grown so much that the root of the *Trifolium*, which was curved round the tuber, lay imbedded in a groove formed by the growth of the latter, but actual union only existed at the apex of the root which penetrated into the substance of the tuber.

The point which has always struck me most in observing the parasitism of *Orobanche* is the small size of the root to which they are always attached, and it appears to me that there is much yet to be explained both in this tribe and in all the other root parasites. The presence of proper roots would seem to indicate that the parasites are not wholly nourished from the foster-plant, a conclusion which irresistibly presses upon us when we see a tall *Orobanche* some two feet high and three-quarters of an inch thick attached to a slender root not measuring a quarter of an inch in diameter. Their own proper roots in *Orobanche* are small and few in number, and I believe that in *O. rapum* at least, the whole tuber with its scales is an absorbing organ. My reason for this supposition is the condition of its tissues. The tuber and scales are composed almost wholly of succulent cellular tissue; the epidermis resembles the epithelium of roots, and like it dries up and becomes discoloured very rapidly on exposure to the air. These structures are manifestly as well adapted to the absorption of fluid nourishment as the aerial roots of the epiphytic *Orchidaceæ*, and I see no objection to the assumption that they are so employed.

The question of the parasitism is not interfered with by the above proposition; but we have to account for the assimilation of

the nutriment and the formation of large quantities of starch and highly carbonized resinous matters in plants devoid of leaves or other green parts. Of this I can offer no explanation without going into hypotheses regarding assimilation in general, which I am not willing to do here; I will only observe, that I believe assimilation to be a process wholly distinct and independent of the respiration, liberating oxygen, in the green parts of plants.

The specimens in which I traced the connection of the parasite with the root of the foster-plant were *single* and small; in other cases I found a group of two or three large specimens attached together and to a decayed tuber, probably of the former year, and having no apparent connection with a foster-plant. This point requires further observation; but these cases suggest that the *seedling* plant may require a foster-plant, while those produced by buds from an old plant are less dependent; just as the green parasites in the Rhinanthaceæ are apparently independent after they have acquired a certain degree of development.

The development of the ovary confirms Mr. Brown's view of its structure, in opposition to the opinion expressed by Dr. Lindley. I have satisfied myself, by tracing the formation from the earliest stages, that the carpels stand fore and aft, and not laterally. A section of the perfect style also, just below the stigma, exhibits two vascular bundles, one in front and one behind, opposite the sutures of dehiscence, so that the lobes of the stigma each belong half to each carpel. The supposed analogy with Gentianaceæ therefore falls to the ground, while that with Scrophulariaceæ is real.

V.—*Remarks on the British Geodephaga; with Notes on some Scydmaenidæ and Pselaphidæ.* By Dr. H. SCHAUM*.

No attempt to reconcile, even in a tolerably satisfactory manner, the great difference which exists between the usual English nomenclature and our own, has hitherto been successful. Of the more numerous and difficult genera of insects, an understanding can scarcely be obtained without interchanging specimens or studying the original collections. The descriptions of the English writers, which perhaps may suffice to make known to the

* Translated by Wm. S. Dallas, Esq., from the 'Entomologische Zeitung' for February 1848, pp. 34-44, and communicated by him.

[These introductory remarks of Dr. Schaum apply only to Coleoptera, for Mr. Henry Doubleday and Mr. Stainton have done much to rectify the nomenclature of the nocturnal smaller Lepidoptera, while Messrs. Shuckard, F. Smith, Haliday, Walker and others have laboured, and by foreign works have determined the species of many groups of Hymenoptera and Diptera.]

native collectors the comparatively few species of the scanty British fauna, are not sufficient for the entomologists of the continent, who have a richer field before them. Recognition from descriptions, besides, becomes still more difficult, because insects which are represented by English writers under names given by Gyllenhal, Dejean, or other authors, are frequently incorrectly determined, and consequently cannot serve as starting-points for the settlement of the other species. An interchange of specimens has not yet been successfully introduced, for most of the English collectors, induced by the insular position of Great Britain, confine themselves entirely to the investigation of their own fauna, and usually feel no interest whatever in continental insects.

A two months' residence in London gave me the opportunity of seeing the collection of Mr. J. F. Stephens frequently, and as the most liberal permission to make use of it was granted to me by the kind owner, I resolved to investigate thoroughly some families contained in it, considering this more advantageous than collecting notes on individual species of different families. I chose *Carabici* and *Hydrocanthari*, with which I am most conversant, and in which I promised myself most success. I should willingly have investigated some other groups, such as the *Elaters* and a part of the *Palpicornes*; but my stay in London was too short, and my time too much occupied to admit of this; and besides, I dreaded making erroneous statements in many cases, from the impossibility of now and then comparing correctly determined specimens of German species.

It is to be wished that English entomologists, following Walton's example, would set themselves to the task (and attend to it closely) of studying individual families, so as to bring about in them an agreement between the English nomenclature and that employed on the continent. Walton's laborious works on the British Curculionidæ are published in Taylor's 'Annals of Natural History,' and I hope the 'Entomologische Zeitung' may soon give us translations of his last essays.

I will now go through the genera of *Carabici* in their order.

Cicindela sylvicola.—The specimen figured by Curtis, which is in the collection of Mr. J. F. Stephens, is a green variety of *C. hybrida*, Dej. The true *C. sylvicola*, Dej., is not indigenous in England.

Dromius fenestratus, Ste., is not *fenestratus*, Fab., Dej., but a variety of *D. testaceus*, Erichs., with a yellow spot on the anterior half of the elytra*. The type of the latter species is mixed with *D. agilis* in Stephens's collection under the names of *D. agilis* and *meridionalis*.

D. bipennifer is *Sigma*, Rossi, Dej.; *D. impunctatus* belongs to

* This variety is described by Dejean, i. p. 242, as *D. agilis*, var. *a*.
Ann. & Mag. N. Hist. Ser. 2. Vol. iii.

D. obscuroguttatus, Duft., *spilotus*, Dej. *D. angustatus* and *maurus* are not distinct, and both = *D. maurus*, St.

Lamprias (*Lebia*) *nigritarsis* does not appear to me to differ from *L. cyanocephala*, nor *L. rufipes* from *L. chlorocephala*.

Tarus humeralis is Dejean's *Cymindis* of the same name. *T. macularis* and *axillaris* are mutually identical, and perhaps only a variety of *C. humeralis* with a dark red prothorax; at all events quite distinct both from *C. macularis*, Dej., and *C. axillaris*, Dej. *T. coadunatus*, *laevigatus*, *homagricus* and *angularis* again form one species, which is identical with *C. homagricus*, Dej. *T. basalis* is the Gyllenhalian species of the same name. It appears consequently that there are three species of *Cymindis* indigenous to England—*C. humeralis*, *homagricus* and *basalis*.

Brachinus crepitans.—To this species, the specimens named in Stephens's collection *B. immaculicornis*, *explodens* and *glabratus* appeared to me to belong.

Almost the whole of the English species of the genus *Dyschirius* are known on the continent under other names; only *D. nitidus*, *politus*, *æneus* and *gibbus* of Stephens are, the first probably, and the three others certainly, the like-named species of Dejean and Putzeys. Of the others, *D. minimus* is the same as *D. gibbus*; *D. pusillus*, *ovatus* and *thoracicus* are not distinct from *D. æneus*; *D. tristis* is a specimen of the same species inclining, in colour, to blue; *D. rufipes* and *punctatus* are the same as *D. salinus*, Schaum, Putz.; *D. arenosus* is an immature specimen of the true *D. thoracicus*, Fab., Er., Putz.*; *D. cylindricus* the same as *D. politus*, and *D. inermis*, *digitatus* and *fulvipes* form one species, and are identical with *D. arenosus*, Putz. (non Steph.). Putzeys has been misled, by an incorrectly determined specimen in Hope's collection, into describing this marked species (which I found in plenty on the sea-shore near Swinemünde in the summer of 1845) as *D. arenosus*, Ste. The name *D. inermis*, under which Curtis has so beautifully figured it, will be retained for this species.

The English specimens of *Nebria livida* all belong to *N. lateralis*, Fab.: the true *N. livida* is not indigenous in England.

Helobia (*Nebria*) *lata*, Newm., is, according to the original specimens, only a rather large variety of *H. brevicollis*, and *H. varicornis*, Newm., is described from immature specimens of the same species. *H. æthiops*, Ste., is a large specimen of *Gyllenhalii*, Schönh., of which *H. Marshallana*, Ste. (*arctica*, Dej.) is an alpine form.

Leistus nigricans, Newm.—The original is an old, dark specimen of *L. spinibarbis*. *L. Janus*, Newm., is described from immature specimens of *L. fulvibarbis*, Dej. *Leistus montanus*, Ste., is a very marked species of this genus, apparently unknown on the continent. *L. indentatus*, Newm., is unknown to me, as I have not seen the original specimen; it is most probably not a distinct species, and the depression described merely accidental.

* This was the only specimen of this species (*D. thoracicus*, Fab.) in Stephens's collection; it is not rare in England however, and has been taken by Wollaston in great plenty.

Trimorphus scapularis and *confinis*, Ste., are the same as *Badister humeralis*, Bon. ; *T. erro*, Newm., is identical with *B. peltatus*, Ill.

Badister suturalis.—The specimen originally described and figured by Stephens is a pretty variety of *B. unipustulatus*, Bon., *cephalotes*, Dej. The specimens which Stephens subsequently received and mentioned in the 'Supplement to his Illustrations' are of a similar variety of *B. bipustulatus*. To the latter species *B. microcephalus*, Ste., also belongs.

Epomis circumscriptus, Duft., is not indigenous in England ; in Stephens's collection I found under this name two different *Chlænii* from the Cape.

Chlænium fulgidus, Ste., is an immature specimen of *C. melano-cornis*, which has shrivelled in drying ; *C. xanthopus*, Ste., is a North American species allied to *C. cobaltinus*.

Agonum austriacum is *modestum*, Dej. ; *A. fulgens*, Ste., is identical with *A. Ericeti*, Panz., Sturm ; *A. plicicolle* is a deformed specimen of *A. viduum* ; *A. viduum*, Erichson's species of the same name. *A. versutum*, *læve*, *emarginatum*, *mæstum*, *lugubre* and *afrum* all appeared to me to belong to *A. mæstum*, Erich. *A. Bogemanni* I have not seen, the species not being in Stephens's collection.

A. quadripunctatum differs entirely from *quadripunctatum*, DeGeer, and appeared to me to be *A. fuliginosum*, Knoch ; *A. consimile* I look upon as *A. scitulum*, Dej., and *A. atratum*, Ste., as *gracile*, Sturm, Dej. ; *A. piceum*, *Simpsoni*, *pullum*, *striatum* and *fuliginosum* are all to be united as *A. fuliginosum*, Knoch ; *A. micans* and *cursitor* correspond with *A. micans*, Nicolai, Er., *pelidnum*, Duft., Dej. ; *A. picipes* is the species so called by Dejean and Erichson. *A. fuscipenne* and *gracile* belong again to *fuliginosum* ; *A. pelidnum* is *Thoreyi*, Dej., a species not rare in England ; *A. affine* is the true *A. pelidnum*, Payk., Gyll., Er., *puellum*, Dej. ; *A. pusillum* is a single minute specimen, and therefore difficult to determine ; perhaps it is also to be united to *A. fuliginosum* ; *A. livens* is the Gyllenhalian insect of the same name.

Odontonyx rotundicollis, Marsh., is the same as *Olisthopus rotundatus*, Payk.

Calathus apicalis, Newm., is described after an immature specimen of *C. melanocephalus* ; *C. crocopus* and *fuscus* are to be united with *C. flavipes*, Payk., Sturm ; *C. rufangulus* is the genuine *C. fuscus*, Fab., Dej., Er. ; *C. mollis* is *ochropterus*, Duft., a plentiful species at Liverpool, under stones near the sea ; *C. nubigena*, Haliday, is a distinct species which has been discovered in Ireland.

Platyderus ruficollis is *Feronia* (*Pterost.*) *depressa*, Dej.

Argutor inquinatus is a large variety of *F. vernalis*, Dej. ; *A. rufo-marginatus* and *vernalis* are specimens of the same species of ordinary size ; *A. inæqualis*, *Scalesii* and *longicollis* are varieties of *A. longicollis*, Duft., Sturm, *ochraceus*, Sturm, *negligens*, Dej. ; *A. diligens* is *A. strenuus*, Ill., Panz., *pullus*, Gyll., Dej. ; *A. interstinctus*, *erythropus*, *strenuus* and *pullus* all belong to *A. pygmaeus*, Sturm, Er., *strenuus*, Dej. ; *A. anthracinus* is *Feronia minor*, Dej.

Pogonus Burrellii is *P. luridipennis*, Germ. ; *P. chaldeus* and *litto-*

ralis correspond with *halophilus*, Germ., Dej.; *P. æruginosus*, Ste., is the genuine *P. littoralis*, Duft., Sturm.

Omascus Orinomum is not to be divided from *O. Bulwerii*; the species is not known to me under any other name; *A. lævigatus*, Ste. is *F. minor*, Dej., again; *O. rufifemoratus* is a variety of *O. nigrita* with red thighs; *O. tetricus*, Haliday, and *O. rotundicollis*, Ste., are *F. gracilis*, Dej.; *O. affinis* is a monstrous specimen of *O. melanarius*; *Feronia picea* is *picimana*, Duft., Dej.

Amara acuminata, *obsoleta*, *similata*, *trivialis*, *vulgaris*, *spretta*, *familiaris*, *communis* and *tibialis*, Ste., are the Erichsonian species of the same names; *A. ovata* belongs to *A. obsoleta*, as do also *A. ingenua* and *subænea* of the Stephensian collection, but the descriptions of the two last in Stephens's 'Manual' are repetitions of those given by Erichson under those names. Stephens's descriptions of *A. municipalis*, *brunnea*, *curta* and *patricia* are also borrowed from Erichson, the genuine species of these names not existing in his collection. The specimen there marked as *A. curta* is a dark *A. spretta*; the original specimen of the *A. discrepans*, Marsh., referred by Stephens to *A. brunnea*, is an *A. bifrons*; the Stephensian descriptions of *A. municipalis* and *patricia* are not founded on specimens. The other species of the genus answer to ours as follows, viz.: *A. nitida*, Ste., is the true *A. plebeja*, Gyll., *A. laevis* and *lucida* belong to *A. familiaris*, *A. convexior*, *plebeja*, *obtusa* and *atrocærulea* to *A. communis*, Gyll., and *A. erythroga* and *infima* to *A. gemina*, Er.; *A. atra* is a black variety of *A. trivialis*, *A. laticollis* probably the true *A. nitida*, Sturm, Er., and *A. tricuspidata* is a species unknown to me, distinct from *A. tricuspidata*, Dej., perhaps *A. depressa*, Er.

Bradytus crassus is identical with *A. consularis*, *B. marginatus* the same as *A. patricia*, *B. torridus* an immature female of *A. apricaria*, and *B. fulvus* and *ferrugineus* are mutually identical.

Harpalus serripes, *tardus* and *stygius* belong to *H. serripes*, as do also *H. fuscipalpis* and *tenebrosus*, whilst *H. rufimanus*, *fuliginosus* and *latus* constitute the true *H. tardus*, Ill., Dej.; *H. nigripes*, *piger*, *unzius*, *femoralis*, *complanatus*, *flaviventris* and *luteicornis* are all only slight varieties of *H. anxius*; *H. luteicornis* for example being a small female, and *H. complanatus* and *flaviventris* immature specimens. *H. thoracicus*, *depressus* and *melampus* are the same as *H. semiviolaceus*, Dej.; *H. Petisii*, *rubripes*, *azureus*, *chloropterus*, *marginellus*, *fulvipes* and *lentus* are varieties, sexual or otherwise, of *H. rubripes*; *H. caffer* is the true *H. perplexus*, Gyll., Dej.; *H. rufitarsis* a small, and *H. calceatus* a large specimen of *Anisodactylus binotatus*. Upon the other *Harpali* I cannot venture to pronounce any opinion; they are mostly species which are rare in the north-east of Germany and are less known to me.

Pangus scaritides, a single female, which has nothing in common with *Selenophorus scaritides*, and appeared to me scarcely distinct from *Actephilus pumilus*, Ste.

Actephilus vernalis is *H. picipennis*, Dej.; *A. pumilus* is not known to me with certainty.

Ophonus stictus appeared to me to belong to *H. monticola*, Dej.

(the genuine *Carabus obscurus*, Fab.); *O. punctatulus* and *nitidulus* are mutually identical, and the same as *H. punctatulus*, Dej.; *O. punctatissimus* may perhaps be *subcordatus*, Dej.; *O. foraminulosus* appeared to me to belong to *puncticollis*, Payk., Dej., and *O. puncticeps* to be a small variety of the same species, whilst *O. puncticollis*, *subpunctatus* and *cribellum* might answer for the *H. brevicollis*, Dej. I will not however give out these statements as absolutely certain.

Stenolophus Skrimshiranus might perhaps correspond with the *S. melanocephalus*, Findel, which is described by Dejean as a variety of *S. vaporariorum*, but I am not convinced that it is so.

Most of the specimens of *Trechus dorsalis* in the Stephensian collection belonged to *Stenol. elegans*, Dej.; *Trechus parvulus* is an immature *St. dorsalis*, Dej.; *T. flavicollis* is *Acup. luridus*, Dej., but not *T. flavicollis*, Sturm; *T. nitidus* is identical with the preceding; *T. ruficollis* is *Bradycellus similis*, Er., and *T. placidus* the *Bradycellus placidus*, Er.; *T. suturalis* is *Acup. cognatus*, Gyll., Dej. The specimens with a reddish thorax which are mentioned in Stephens's descriptions belong to *placidus*, Gyll.; I cannot distinguish *T. fulvus* from *Acup. Harpalinus*, Dej.; *T. pallidus* is founded on immature specimens of the same species.

T. brunripes is a species of *Bradycellus* not otherwise known to me, nearly allied to *B. Harpalinus*, and distinct from *Stenol. brunripes*, Sturm, Er.; *T. consputus* and *meridianus* are the species so called by Erichson; *T. cognatus* is nothing but a specimen of *T. meridianus*; *T. aquaticus*, with its varieties *T. fuscipennis* and *tristis*, is identical with *T. minutus*, Er., and *T. laevis* is a large specimen of the same species.

Blemus paludosus is Dejean's *Trechus* of the same name; *B. pallidus* answers exactly to the description of *Trechus fulvus*, Dej., but does not agree with *T. pallidus*, Sturm. Of the true *B. longicornis*, Sturm, I have seen no English specimen.

Lymnæum nigropiceum is a very marked species, which was previously quite unknown to me.

Tachys scutellaris is the same as *Bemb. scutellare*, Dej.; *T. binotatus* and *vittatus* the same as *B. guttula*, Dej., Er.; *T. inermis*, *pusillus*, *obtusus* and *gracilis* belong to *B. obtusum*, Sturm, Dej.; *T. minutissimus* and perhaps also *T. minimus*, Curt., which I have not seen, are identical with *B. bistriatum*, Dej.; *T. maritimus* is not in Stephens's collection.

Philochthus æneus is *Bemb. æneum*, Germ.; *P. Doris*, *subfenestratus* and *biguttatus* appeared to me to belong to *B. vulneratum*, Dej.; and *P. guttula* to *B. biguttatum*. The typical specimen of *B. hæmorrhous*, Kirby, is a *B. guttula*, Dej. Specimens of *B. obtusum* have been confounded with it by Stephens.

Ocys currens is *Bemb. pumilio*, Dej.; *O. melanocephalus* and *tempestivus* are the same as *B. rufescens*, Dej.

Peryphus femoratus and *concinus* appeared to me to belong to *Bemb. Bruxellense*, Putz., and the second is certainly different from *B. concinnum* of Putzeys. Under *P. maritimus* several species are confounded; of the four specimens in the Stephensian cabinet, two

belong to the preceding species, one to *B. concinnum* of Putzeys, and the fourth to *B. rupestre*, Dej.; *B. tetraspilatus* is wanting in Stephens's collection. Two specimens which Wollaston communicated to me under this name belonged to *B. rupestre*, Dej.; *P. littoralis* is *B. rupestre*, Dej.; *P. lunatus* and *ustus* are *B. lunatum*, Duft., *P. lunatus* being established on immature and *P. ustus* on mature specimens of that insect; *P. decorus* and *albipes* correspond with *P. brunripes*, Dej., *P. albipes* being the young specimens; *P. nitidulus*, Marsh., is *P. rufipes*, Dej., and *P. agilis* the same as *B. decorum*, Dej. On the other species of the genus *Peryphus* I cannot venture to give any decided opinion.

Notaphus undulatus is *Bemb. undulatum*, Dej., Er.; *N. ustulatus*, *nebulosus*, *semipunctatus* and *obliquus*=*B. ustulatum*, Dej., Er.; *N. stictus* may correspond with the lately described *N. Dejeanii*, Putz.; *N. fumigatus* is Dejean's *Bembidium* of the same name; *N. ephippium*=*B. pallidipenne*, Dej. (non Ill.); *N. castanopterus* is a pale variety of *B. assimile*, Gyll., Dej., Er.

Lopha pæcila=*B. articulatum*, Dej.; *L. quadriguttata* and *quadrimaculata* are Dejean's species of the same names; *L. pulchra* is a bluish specimen of *B. celere*; *L. assimilis*=*B. Doris*, Ill., Dej., Er.; *L. pusilla* and *hæmorrhoidalis* are also the same as *B. Doris*, Ill.; *L. nigra*=*B. Mannerheimii*, Sahlb., Dej.; *L. pulcuria* and *minima*=*B. pusillum*, Gyll., Dej.; *L. nana* is wanting in Stephens's collection; *L. Doris* and *Spencii*=*B. assimile*, Gyll., Dej.

Tachypus celer=*Bemb. celere*; *T. acutus*, Marsh., is an immature specimen of the same species; *T. properans*, *chalceus* and *orichalcicus*=*B. velox*, Er.; *T. bipunctatus*=*B. bip.*, Dej., &c.; *T. chlorophanus* and *striatus*=*B. ærosum*, Er.

Bembidium impressum is quite distinct from *B. impressum*, Dej., being nothing but an ill-preserved specimen of *B. flavipes*.

Notiophilus tibialis, Ste.=*N. palustris*, Er., whilst *N. palustris* of the Stephensian collection belongs to *N. biguttatus*, Er.

[As Dr. Schaum's remarks on the British Water-beetles, which form a part of his paper in the 'Entomologische Zeitung,' have already appeared, in a more detailed form, in this country (see Zoologist, pp. 1887 and 1932), it has not been considered necessary to reproduce them here.]

PSSELAPHIDÆ AND SCYDMENIDÆ.

Scydmanus ruficornis, Denny, is nothing but the female of *S. denticornis*. I have compared two of the specimens mentioned by Denny himself.

S. Wighami, Denny (also according to an original specimen which E. Doubleday communicated to me) is identical with *S. angulatus*, Kunze. The species could not be recognized from Denny's imperfect figure.

S. punctipennis, Ste., is a true *S. collaris*.

S. Dennii, Ste., as I had previously supposed, is the male of *S. denticornis*. Several species of this genus were incorrectly determined

in Stephens's collection; the descriptions in his works however are not taken from these specimens, but borrowed from Denny.

Euplectus Kirbii, Denny, of which I have examined the original specimen in the British Museum, is not identical with *E. signatus*, as Erichson and Aubé suppose, but with *E. Fischeri*, Aubé (*Tischeri*, Heer). Denny has overlooked the pit in the forehead which characterizes this species.

Stephens refers the *Euplectus sanguineus*, Denny, as a synonym to *E. minutus* of Marsham, but incorrectly; the specimen of the latter differs in nothing from an ordinary *E. signatus*.

E. ruficornis, Ste., is synonymous with *E. ambiguus*, Reichb.

Bythinus grandipalpus, Ste., is the female of *B. Curtisii*, Denny.

Bryaxis assimilis, Curt., I have not seen.

The specimen named *Bryaxis insignis*, Reichb., in Stephens's collection, does not agree at all with the true *P. insignis*, Reichb. (= *Tyrus mucronatus*), but is the same insect as *Bryaxis juncorum*.

VI.—On the mode of growth in *Oscillatoria* and allied genera.

By JOHN RALFS, M.R.C.S., Penzance*.

THE growth of the lower Algæ by repeated transverse division of their cells is now a well-established fact. In the *Desmidiæ* and the *Palmellæ* this division is usually complete and gives rise to distinct individuals. In the latter family the common gelatinous matrix mostly retains them in such close connection that the entire mass is regarded as a frond, of which the cells are only portions. The case is essentially similar in the *Desmidiæ*; but in them the common matrix is so exceedingly thin that it can scarcely be detected, whilst the slightest touch scatters the cells, rendering their independence apparent, and hence each individual is considered a frond.

In *Tiresias* and many other simple, filamentous Algæ, the divided cells remain closely united, and form a jointed filament which continues to elongate until the cells cease to divide.

I believe that in *Oscillatoria* we may trace a mode of growth of an intermediate kind and connecting these extremes. In many species of this genus the stratum spreads with great rapidity. This rapid growth cannot be caused by zoospores or granules vegetating in constant succession, because, although the filaments vary in length, their breadth is uniform. It does not depend on the simple elongation of the filaments, because, in many species, the filaments always remain short, notwithstanding the great increase of the mass.

The difficulty of tracing the growth in *Oscillatoria* is enhanced by its cells being frequently confluent, or having their divisions

* Read before the Botanical Society of Edinburgh, December 14, 1848.

marked merely by faint transverse striæ. Still that the cells divide as in the other simple Algæ will scarcely be contested, if indeed the fact be not sufficiently proved in those species which have some of the striæ about twice the ordinary distance apart, as is always the case when cells are dividing.

In general the cells are indicated, as I have just stated, by more or less evident transverse, straight striæ; but at certain intervals the junction margins become rounded during division and the filament separates into distinct portions. All the *Oscillatorieæ* have the filaments inclosed in sheaths. When the sheath divides together with the cell, the original filament at once forms two; and as this process is continually going on, we can easily conceive the rapid extension of the stratum consequent upon the progressive increase in the number of filaments.

It may be necessary to mention, that it is easy to distinguish between a natural separation and a fracture. In the latter case the ends formed by violence are abrupt; in the former they are usually rounded.

When, as in some species, there is a complete separation of the internal filament unaccompanied by simultaneous division of its sheath, the latter retains the portions in connection. *Lyngbya ferruginea* affords a good example of this kind, and as its filaments are stouter than those of most species of *Oscillatoria*, no better plant can be selected for observation. If a portion of the stratum be examined, filaments of various lengths may be seen mingled together; but they are all of the same breadth, although some of them are not longer than broad.

When separated portions are thus held together by the sheath, there is generally a short interval between them. Whether this results from an elongation of the sheath or the mutual repulsion of the inclosed portions is doubtful. The latter I consider as the more likely cause. May it not be produced by an electric current developed at the instant of partition? Perhaps the radiation of the filaments from the stratum, in some species of *Oscillatoria*, may be similarly accounted for.

Microcoleus is known by its numerous, short, simple *Oscillatoria*-like filaments being contained within either a simple or a slightly branched, inflated sheath or frond. The presence indeed of this common covering is the character which separates *Microcoleus* from *Oscillatoria*; for the filaments and their manner of division are alike in both.

In *Oscillatoria* the parted filaments are retained together merely by the common mucus which permits a comparatively wider range, and allows them to diverge in various directions. In *Microcoleus*, on the contrary, their freedom is restricted; the frond by its form and size keeps them parallel and binds them

in bundles. At first the frond contains only one or two filaments (as correctly stated by Mr. Hassall in his 'British Fresh-water Algæ'); but these dividing as in *Oscillatoria*, the inflated frond becomes completely filled and at length ruptured, when the filaments escape from it to form new plants.

I intend in a future communication to offer some evidence in proof that the appositional branches in *Rivularia*, *Calothrix* and other genera are merely modifications of the mode of growth here described.

VII.—On the Structure of the Teeth of some Fossil Fish of the Carboniferous Period. By Prof. OWEN, F.R.S.

To the Editors of the *Annals of Natural History*.

GENTLEMEN,

IN the interesting and instructive summary of the modifications of the teeth in fossil fishes of the carboniferous period which Mr. M'Coy has given in the 'Proceedings of the Cambridge Philosophical Society,' June 1848, he notices a layer of true enamel in '*Centroodus*,' which he says "is quite distinct from that dense modification of *dentine*, which, forming the polished surface of most fish-teeth, has been confounded with true enamel, but which it is here proposed to call '*ganoine*' in future descriptions" (p. 65). I have long been in the habit of applying the term '*ganoine*' to the peculiar tissue which forms the enamel-like surface of '*ganoid scales*;' but, as the term has been published by me in no other way than orally in lectures, I should be willing to resign it for the new dental tissue which Mr. M'Coy professes to have discovered, if his claim to the discovery were sound. If I mistake not, Mr. M'Coy first announced his discovery in your 'August Number' of the present year, p. 124, where, after animadverting on the frequent mistake of his new modification of *dentine* for true enamel, he says: "The latter is, however, secreted by a distinct organ quite external to and independent of the *dentine*, while the false enamel, which I propose to call '*ganoine*,' is merely produced by the calcigerous tubes of the *dentine* becoming suddenly straighter, closer and more numerous as they approach the surface" (p. 124).

In my '*Odontography*' I defined what I believe to be the '*ganoine*' of Mr. M'Coy in the following words: "In some instances, as in the teeth of the flying-fish (*Exocætus*) and sucking-fish (*Remora*), the substance of the tooth is uniform, and not covered by a layer of a denser texture. In others, as the shark, *sphyræna*, &c., the tooth is coated with a dense, shining, enamel-

like substance ; but this is not true enamel, nor the product of a distinct organ ; it differs from the body of the tooth only in the greater proportion of the earthy particles, their more minute diffusion through the gelatinous basis, and the more parallel arrangement of the calcigerous tubes ; but it is developed in and by the same matrix, and resulting from the calcification of its external layer, is the first part of the tooth which is formed" (p. 8). I then go on to cite the fishes that have true enamel, developed from a distinct organ (p. 9) : and the modifications of the enamel-like dentine are described at pp. 34, 54, 56 *et passim**. To most of the modifications of dentine in fish-teeth I have assigned and published names, *e. g.* 'osteodentine,' 'vasodentine,' 'plicidentine,' 'dendrodentine,' 'labyrinthodentine'†: if it be really requisite to give a name to the modification of hard dentine above defined, I would suggest to Mr. M'Coy the desirableness of adhering to the terminology already in use. The term 'ganoine' is required for the enamel-like tissue of ganoid scales, and that of 'vitrodentine' would have been the one I should have proposed for the tissue which I believe myself to have first defined, had I not been checked by the observation of the very gradual passage of hard or true dentine into it in many fishes, and by the natural desire to reduce the number of new terms to the minimum which the exigences of science seemed to require.

From the terms of the descriptions quoted from the 'Annals and Magazine of Natural History,' 1848, p. 124, and from the 'Proceedings of the Cambridge Philosophical Society' for June 1848, anatomists might be led to cite the subject of them as the 'ganoine of M'Coy ;' but I am sure that gentleman is above the device by which small zoologists, of what our plain-speaking German brethren call the 'Gattungsmacherei,' endeavour to appropriate a new species discovered and defined by another, by the mere imposition of a name.

I remain, Gentlemen, your very obedient servant,

RICHARD OWEN.

* The texture of the tooth of *Ctenodus* is described as presenting "a coarse osseous structure at the base, supporting a dense osseous or enamel-like layer," p. 63. Although in defining the obvious external characters of the tooth of *Petalodus* the term 'enamel' is used, I am careful, in describing the structure, to state that "the short terminal branches of the medullary canals, which distribute the calcigerous tubes to the enamel-like outer layer, are slightly bent downwards," &c., p. 62: so that after the previous definition of the 'enamel-like' substance at p. 8, no mistake could be made.

† 'Odontography' and 'Lectures on Vertebrata,' tom. i. p. 226.

VIII.—*Descriptions of Aphides*. By FRANCIS WALKER, F.L.S.

[Continued from vol. ii. p. 431.]

56. *Aphis dirhoda*, n. s.

This species feeds on the rose with *Aphis Rosæ*, and is sometimes far more numerous than that species in the spring and in the autumn, but its appearance is less regular; it frequents various species of rose both wild and cultivated, such as *Rosa centifolia*, *R. canina*, *R. eglanteria*; and in the summer it migrates to different species of corn and of grass (*Secale*, *Triticum*, *Avena*, *Hordeum*, *Bromus*, *Dactylis*, *Holcus*, and *Poa*), and it fixes itself on the blades of these plants, whereas *A. Avenæ* prefers the flowers. *Aphidius Avenæ*, an *Allotria*, *Asaphes anea*, and *Megaspilus Carpenteri*, are its parasites, and these will be more particularly noticed in another part of these descriptions.

The viviparous wingless female. This sometimes rests through a severe winter under the rose-leaves without being injured, and begins to multiply very early in the spring: it is oval, and pale greenish yellow: the feelers have pale brown tips, and are about one-fourth of the length of the body: the eyes are dark red: the mouth and the nectaries are pale yellow with brown tips, and the latter are about one-sixth of the length of the body: the tip of the abdomen is brown: the legs are shorter and more slender than those of *Aphis Rosæ*, and the feet are pale brown: it is also distinguished from that species by its paler colour, its shorter feelers, and its larger body; the two kinds may often be seen together on one rose-twigg, each surrounded by its respective little ones.

The front is prominent in the middle between the eyes: the tubercles on which the feelers are seated are rather less developed than those of the preceding species; the fourth joint of the feelers is much shorter than the third; the fifth is shorter than the fourth; the sixth is not half the length of the fifth; the seventh is nearly as long as the third.

The viviparous winged female. While a pupa it much resembles the wingless female in colour: its wings are unfolded in April or May, and then it is pale green: the chest is buff; its lobes are pale brown: the feelers are brown, green at the base, and much shorter than the body; the fourth joint is shorter than the third, and the fifth is shorter than the fourth; the sixth is nearly half the length of the fifth; the seventh is a little shorter than the third: the eyes are dark brown: the mouth has a brown tip: the nectaries are about one-sixth of the length of the body: the legs are pale yellowish green and rather long; the feet and the tips of the thighs and of the shanks are brown: the wings are colourless,

and nearly twice the length of the body ; the wing-ribs and the rib-veins are pale yellowish green ; the veins are brown.

1st var. The feelers are black, and as long as the body : the nectaries are pale green with black tips, and about one-fifth of the length of the body. In the autumn.

2nd var. Pale yellowish green : the lobes of the chest and the breast are dark gray : the feelers are green at the base, and longer than the body : the other limbs are pale yellow : the tip of the mouth, the eyes, and the tips of the nectaries are black, and the latter are nearly one-fourth of the length of the body : the knees, the feet, and the tips of the shanks are black : the wing-ribs and the rib-veins are pale yellow ; the wing-brands are pale brown, and the other veins are brown. In the autumn, when the winged females abound on the rose-leaf, and each of them is surrounded by a group of its white or pale green little ones.

Variation in the wing-veins. The second vein is forked, but the third is undivided.

The oviparous wingless female. This species in its nuptial state is born of the winged female during October and some part of November, and is very delicate and pretty : it has a pale lemon colour : the head is almost white : the eyes are dark red : the limbs are white : the feelers are blackish towards their tips : the tip of the mouth and the tips of the nectaries are black, and the latter are as long as one-fifth of the body : the knees and the tips of the shanks are pale brown ; the feet are black : the hind-shanks are sometimes pale brown.

1st var. Green. 2nd var. Pale straw-colour. 3rd var. Buff. 4th var. Light buff varied with pale red. 5th var. Rose-colour. 6th var. Saffron. 7th var. Orange.

The winged male. It pairs with the oviparous female in October and November, and is buff : the head, the disc of the chest and that of the breast are brown : the abdomen has a black line along the back and a row of black dots on each side : the feelers are black, dull buff at the base, and much longer than the body : the fourth vein is much shorter than the third ; the fifth is hardly shorter than the fourth ; the sixth is less than half the length of the fifth ; the seventh is nearly as long as the third : the mouth is pale buff ; its tip and the eyes are black : the nectaries are pale buff with black tips, and one-fifth of the length of the body : the legs, especially the thighs, are pale yellow ; the knees, the feet, and the tips of the shanks are black ; the wing-ribs and the rib-veins are pale yellow ; the wing-brands are pale brown ; the other veins are brown.

1st var. Pale orange : the head, the disc of the chest and that of the breast are black : the feelers are pale orange towards the base : the eyes are dark red : the nectaries are dull brown, and as

long as one-fourth of the body ; the thighs excepting the base are black.

2nd var. The nectaries are yellow with black tips.

57. *Aphis Avenæ*, Fabr.

Aphis Avenæ, Fabr. Sp. Ins. ii. 386. 17 ; Syst. Ent. 736. 15 ; Ent. Syst. iv. 214. 21 ; Syst. Rhyn. 297. 21 ; Gmel. ed. Syst. Nat. i. 4. 2206. 5 ; Vill. Ins. 551. 50 ; Schrank, Faun. Boic. ii. 1. 104 ; Stewart, ii. 110 ; Macq. Ann. Sci. Nat. 1831, 468 ; Kalt. Mon. Pfl. i. 108. 6.

A. granaria, Kirby, Linn. Trans. iv. 238 ; Curtis, Journ. R. Agric. Soc. vi.

A. Hordei, Kyber, Germ. Mag.

A. cerealis, Kalt. Mon. Pfl. i. 16. 6.

Bromaphis, Amyot, Ann. Soc. Ent. 2^{me} série, v. 479.

This kind feeds on *Secale cereale*, *Triticum æstivum*, &c., *Avena sativa*, *Danthonia strigosa*, *Hordeum vulgare*, *H. murinum*, *Bromus mollis*, *B. secalinus*, *Dactylis glomerata*, *Holcus lanatus*, *Glyceria fluitans*, *Poa annua*, and on other grasses, and also on *Polygonum Persicaria*.

The viviparous wingless female. When young it is dull pale yellow : the feelers are shorter than the body : the mouth has a black tip, and reaches the base of the hind-legs : the nectaries have also black tips, and are as long as one-sixth of the body.

1st var. The body is red. 2nd var. The body is dull green : the hind-part of the abdomen is red.

When full-grown it is red : the feelers are black, and very nearly as long as the body ; the fourth joint is more than half the length of the third ; the fifth is much shorter than the fourth ; the sixth is hardly one-third of the length of the fifth ; the seventh is a little longer than the third, and about five times the length of the sixth : the front is convex in the middle, and has a very distinct lobe on each side, or in other words it is somewhat undulating, and has a projection in the middle and one on each side : the eyes and the mouth are black : the tip of the abdomen is compressed and curved : the nectaries are black, very slightly curved and tapering towards their tips, and between one-fourth and one-fifth of the length of the body : the legs are dull yellow and moderately long ; the knees, the feet, and the tips of the shanks are black ; the shanks are very slightly curved ; the fore-legs are not very much shorter than the hind-legs.

1st var. The body is green, and varieties also occur with every tint between this colour and red.

2nd var. The disc of the body is blackish.

3rd var. The legs are bright pale yellow.

4th var. The thighs are black from near the base to the tips.

5th var. The body is brown : the feelers are black, and longer than the body : the tip of the abdomen is yellow : the nectaries are black, and rather less than one-fourth of the length of the body : the legs are black ; the thighs from the base to the middle and the shanks except their tips are yellow.

6th var. The body is dark green : the feelers are dull green at the base and as long as the body : the mouth is green at the base : the legs are pale green ; the feet and the tips of the thighs and of the shanks are black.

Sometimes green and yellow are variously mixed together in the body ; sometimes it is dull yellow, or pale red, or red with the disc of the abdomen nearly black, and with the thighs black from the middle to the tips, or red with the head green, or green mottled with red, or nearly black, or with a slight metallic tinge. The young ones in the body are sometimes twenty or so in number and of various size : the tubercles which support the feelers are short ; the second joint of the feelers is much shorter and narrower than the first ; the third is much more slender than the second.

The viviparous winged female. It is brown : the lobes of the chest and a row of spots on each side of the abdomen are black : the feelers are black, and a little longer than the body : the mouth is yellow ; its tip and the eyes are black : the nectaries are black, and as long as one-fifth of the body : the tip of the abdomen is yellow : the legs are long and yellow ; the thighs, excepting the base, the feet, and the tips of the shanks, are black : the wings are colourless ; the wing-ribs and the veins are pale yellow ; the wing-brands are pale brown.

1st var. The body is reddish brown : the fore-border and the hind-border of the fore-chest are paler : the abdomen is dull yellowish green with a row of very small black dots on each side : the feelers and the eyes are black, and the former are a little longer than the body : the mouth is dull green with a black tip : the nectaries are a little more than one-fourth of the length of the body : the wing-brands and the veins are brown.

The thighs are of a deeper black and the shanks of a brighter yellow than those of the wingless female. The red colour of this species becomes much brighter when it is preserved in Canada balsam. The colour of the pupa is more often red than that of the wingless female, and the nectaries of the latter are somewhat shorter than those of the former.

2nd var. The body is green with a slight bluish tint : the disc of the head and that of the chest and of the breast are red : the mouth is dull green with a black tip : the nectaries are as long as one-fourth of the body : the thighs are green towards the base. The structure of the wings does not serve to distinguish this from the preceding species.

58. *Aphis Hieracii*, Schrank.

Aphis Hieracii, Schrank, Faun. Boic. ii. 121. 1233; Kalt. Mon. Pfl. i. 17. 7.

The following plants are the food of this species: *Hieracium sylvaticum*, *H. sylvestre*, *H. murorum*, *H. Pilosella*, *H. Sphondylium*, *Crepis tectorum*, and other species, *Carduus*, *Arctium Lappa*, *Ballota nigra*, *Cichorium Intybus*, *C. Endivia*.

The viviparous wingless female. When young it is yellow, elliptical, shining, and covered with short hairs: the feelers are black, pale yellow at the base, and longer than the body: the eyes are dark red: the mouth is pale yellow; its tip is black: the nectaries are dull yellow, and as long as one-sixth of the body; their tips are black: the legs are dull yellow, and moderately long; the feet and the tips of the shanks are black.

1st var. Pale red.

2nd var. Tinged with green: the feelers are shorter than the body.

3rd var. Feelers yellow; tips of the joints black.

When full-grown it is oval, slightly convex, smooth and shining, pale green, or pale reddish green, or reddish yellow: the feelers are very pale green or dull yellow with black tips, and a little longer than the body: the eyes are black: the mouth and the nectaries are pale yellow, or very pale green, with black tips; sometimes the latter are black excepting the base which is pale green; they are nearly as long as one-fourth of the body: the legs are pale yellow or very pale green; the feet and the tips of the shanks, and sometimes also the tips of the thighs, are black.

1st var. Bright yellow: the limbs are pale yellow; the tips of their joints and the nectaries are black.

The viviparous winged female. The pupa is grass-green, rather long and narrow: the feelers are black, green towards the base in the young ones, and a very little longer than the body: the mouth is dull green, and reaches near to the base of the hind-legs; its tip and the eyes are black: the nectaries are black and about one-sixth of the length of the body: the legs are dull green; the thighs are pale yellow towards the base; the feet and the tips of the thighs and of the shanks are black: the rudimentary wings are green: sometimes it is pale green, and its limbs are still paler: when full-grown the legs are black; the base of the thighs and the shanks except their tips are yellow.

When the wings are unfolded it is black and shining: the abdomen is dark green: the feelers are slender and much longer than the body: the mouth is pale yellow; its tip is brown: the nectaries are black, and nearly one-fourth of the length of the body: the legs are long and pale yellow; the thighs, except the base, the feet, and the tips of the shanks, are black: the wings

are colourless, and twice the length of the body ; the wing-ribs are pale yellow ; the wing-brands are pale brown ; the veins are brown.

1st var. While a pupa it resembles the wingless female in colour, but when the wings are unfolded it is dull green or greenish yellow : the discs of the head, of the chest and of the breast are black, and the abdomen has a row of black dots on each side : the feelers are black and as long as the body : the mouth is pale yellow ; its tip and the eyes are black : the legs are also pale yellow with black feet and shank-tips.

2nd var. The body is black : the fore-border and the hind-border of the fore-chest are green : the abdomen is green with black cross-bands, and has a row of black spots on each side : the feelers are a little longer than the body : the mouth is pale green ; its tip is black : the nectaries are about one-fifth of the length of the body : the legs are yellow ; the feet and the tips of the thighs and of the shanks, and nearly the whole of the hind-thighs are black.

Variation in the wing-veins. The lower branch of the first fork is wanting.

The front of the head is prominent in the middle, and has a tubercle on each side for the support of the feelers ; the first joint of these organs is longer and narrower than the tubercle on which it is seated ; the second is shorter and much narrower than the first ; the third is narrower than the second ; the fourth is shorter than the third ; the fifth is shorter than the fourth ; the sixth is about one-third of the length of the fifth ; the seventh is longer than the third : the tip of the abdomen is compressed and very slightly curved.

59. *Aphis Asteris*, n. s.

The viviparous wingless female. It is oval, slightly convex, dull olive-green, very much tinged with red especially round the border, covered with white beneath and sometimes above : it has a row of impressions on each side of the body, and these are most distinct towards the head : the feelers are black, yellow near the base, and longer than the body : the eyes are dark red : the mouth is dull yellow ; its tip is black : the nectaries are black, not curved, and about one-eighth of the length of the body : the legs are long and yellow ; the feet and the tips of the shanks and of the thighs are black. When young it is paler and more linear, and sometimes green. Abundant on *Aster tripolium*, on the shore near Lancaster and at Holywood, near Belfast, in the autumn.

1st var. Almost black, especially towards the fore-chest and the head.

The front is slightly concave in the middle, and convex on

each side at the base of the feelers, but having no tubercles : there is a very little bristle on each side of the front : the feelers are shorter than the body ; the fourth joint is hardly shorter than the third ; the fifth is much shorter than the fourth ; the sixth is less than half the length of the fifth ; the seventh is full thrice the length of the sixth : the back is adorned with six or eight irregular lines of black dots : the tip of the abdomen is compressed, but very short : the fore-legs are not much shorter than the hind-legs ; the shanks are very slightly curved.

60. *Aphis Lactucæ*.

Aphis Lactucæ, Linn. Syst. Nat. ii. 335. 14 ; Fabr. Ent. Syst. iv. 220. 52 ; Syst. Rhyn. 301. 52 ; Réaum. Ins. iii. t. 22. f. 3-5 ; Gmel. ed. Syst. Nat. i. 2205 ; Rossi, Faun. Etrusc. 264. 1401 ; Schrank, Faun. Boic. ii. 1. 120 ; Fonscol. Ann. Soc. Ent. x. 170. 10 ; Kalt. Mon. Pfl. i. 37. 25.

A. Ribis nigri, Sir Oswald Mosley, Gard. Chron. i. 684.

This species feeds on the following plants : *Sonchus oleraceus*, *S. asper*, *S. arvensis*, *Lactuca oleracea*, *Crepis tectorum*, *Picris echioides*, *Ribes nigrum*, *R. rubrum*, *R. grossularia*, *R. uva crispa*. Like *A. Berberidis* it differs from the other species of *Aphis* in having spindle-shaped nectaries.

The viviparous wingless female. This is hatched from the egg in March on *R. nigrum*, *R. grossularia*, and more rarely on *R. rubrum*. At this time and when very young it is light lively green, shining, half-transparent, rather long, slightly convex, and has three rows of minute tubercles along the back : the head is almost white : the feelers are white at the base, brown towards the tips, and rather more than half the length of the body : the eyes are dark red : the mouth and the nectaries are white with brown tips, and the latter are about one-seventh of the length of the body : the legs are almost white ; the shanks are bristly ; their tips and the feet are pale brown.

1st var. Dull dark green with still darker limbs : the feelers are a little shorter than the body, and the nectaries are about one-eighth of its length.

When full-grown it is deep grass-green, oval, and shining : the discs of the head, the chest, the breast and the abdomen are black, and there is a row of black spots along each side of the latter : the feelers are black, and as long as the body : the nectaries are black, spindle-shaped, and nearly one-fifth of the length of the body : the legs are black, long, and rather stout.

1st var. Green, dark green beneath, shaded with black or sometimes all black above : the feelers are a little longer than the body : the mouth is green with a black tip : the nectaries

are cylindrical and about one-sixth of the length of the body : the thighs are green towards the base.

2nd var. Pale green, elliptical, convex, smooth, and shining : the feelers are pale yellow : the tips of the joints are black : the nectaries are about one-sixth of the length of the body ; their tips are pale brown : the legs are pale yellow ; the feet and the tips of the shanks are black.

3rd var. Pale lively green, oval, not shining : the head and the limbs are white, but tinged with green : the feelers are shorter than the body ; the tips of their joints are sometimes black, as are also the tip of the mouth, the knees, the feet, and the tips of the shanks.

4th var. The body is of a fresh light green colour, but not shining ; it has a whitish tinge especially towards the head, and is sometimes mottled with white or with pale red : the feelers are pale yellow, and nearly as long as the body ; the tips of the joints are black : the eyes are dark red : the mouth is pale yellow with a black tip, so also are the nectaries, which are nearly one-fourth of the length of the body : the legs are pale yellow ; the feet and the tips of the shanks are black.

5th var. Of a clear white colour. In the autumn on *Crepis tectoria*.

The viviparous winged female. Green : the head and the fore-chest above are dark green : the disc of the middle chest and that of the middle breast are almost black, and there are black bands across the upper segments of the abdomen : the feelers are black, a little longer than the body, pale yellow towards the base which is dark green : the eyes are dark brown : the mouth is pale green with a black tip : the nectaries are pale green with brown tips, and about one-fourth of the length of the body : the legs are pale yellow, long and slender ; the feet and the tips of the thighs and of the shanks are brown : the wings are colourless, and about twice the length of the body ; the rib-veins are pale green ; the wing-brands are pale buff ; the veins are brown. On the sow-thistle at the end of April.

While a pupa it is green and rather flat : the feelers are dull pale green, and a little longer than the body ; the tips of the joints are black : the mouth is green with a black tip : the nectaries are spindle-shaped, rather dull buff, and about one-sixth of the length of the body : the legs are dull pale green ; the knees and the tips of the shanks are brown.

1st var. The limbs are blackish green.

The wings are unfolded in May, and the Aphis is then black and shining : the fore-chest is green with a black band across it : the abdomen is grass-green ; its disc is chiefly black : the feelers are a little longer than the body : the mouth is pale green with

a black tip : the nectaries are green, spindle-shaped, and about one-sixth of the length of the body ; their tips are black : the legs are pale yellow ; the feet and the tips of the thighs and of the shanks are black : the wings are colourless, and much longer than the body ; the wing-ribs and the wing-brands are pale green ; the veins are brown.

1st var. The mouth is pale yellow with a black tip : the nectaries are cylindrical ; their tips are brown : the feet and the tips of the thighs and of the shanks are also brown.

2nd var. The abdomen is green, and has a row of transverse black spots along the middle of the back, and a row of black dots on each side : the feelers are nearly as long as the body : the nectaries are black : the wing-ribs are pale yellow ; the wing-brands are dull buff.

3rd var. The legs are green ; the thighs except the base and the feet are black : the wing-brands are pale brown.

4th var. Green : the lobes of the chest are brown, and the breast is pale gray : there is a vivid green stripe along the middle of the abdomen, which is whitish beneath : the feelers are pale green towards the base : the eyes are darkred : the thighs are pale green ; the shanks are dull yellow ; their tips and the feet are black : the wing-ribs, the rib-veins, and the wing-brands are pale yellow ; the other veins are pale brown. In the autumn.

5th var. The nectaries are pale yellow, and rather more than one-fifth of the length of the body.

6th var. Black : the borders of the fore-chest, the fore-breast, and the abdomen are greenish yellow ; the back of the latter is varied with black : the nectaries are dark yellow, black towards the base and at the tips, and rather more than one-sixth of the length of the body : the thighs are pale yellow from the base to the middle, and black from thence to the tips ; the shanks are dark yellow, their tips and the feet are black : the wing-brands are brown.

It acquires wings on the lettuce at the end of May. Fourth generation ?

7th var. Pupa. Limbs blackish green.

8th var. Pupa. Pale yellow ; the feelers are as long as the body ; the tips of the joints and the whole of the latter joints are brown : the tips of the mouth, the tips of the nectaries, the feet, and the tips of the shanks are also brown. On the sow-thistle.

9th var. Black : the fore-chest is dark green ; its fore-border and its hind-border are light green : the abdomen is green, and has a large black spot near the tip of the back, and a row of black dots on each side : the nectaries are pale yellow with brown tips : the legs are pale yellow ; the feet and the tips of the thighs and of the shanks are black ; the wing-brands are pale brown.

10th var. Pupa. The body is rose-colour, mottled with yellow: the limbs are yellowish white with black tips: the rudiments of the wings are white with black tips.

11th var. The feelers of the pupa are black, pale yellow at the base: the nectaries are not more than one-fifth of the length of the body: the rudimentary wings are pale brown.

The winged insect is black: the fore-border and the hind-border and the underside of the fore-chest are green: the abdomen also is green, and has a row of black spots on each side of it, and a large black subquadrate spot on its disc: the mouth is pale green; its tip is black: the nectaries are pale green, and as long as one-sixth of the body; their tips are black: the legs are dull yellow; the feet and the tips of the thighs and of the shanks are black: the wing-ribs and the rib-veins are pale yellow; the brands and the other veins are pale brown.

The oviparous wingless female. This occurs in the beginning of November: it is green, shining, and long-elliptic: the abdomen is lengthened towards the tip: the feelers are yellow, black towards the tips, and nearly as long as the body: the eyes are dark red: the mouth is pale yellow with a black tip: the nectaries are yellow with black tips, spindle-shaped, and rather more than one-sixth of the length of the body: the legs are yellow; the thighs are pale yellow, darker towards their tips; the knees, the feet, and the tips of the shanks are black.

1st var. Body varied with darker green, and having three green lines along the back.

2nd var. Body yellowish green: the head, the chest, and the tip of the abdomen are very pale yellowish green: the feelers are black with the exception of the base, and a little longer than the body: the eyes are black: the nectaries are nearly one-fourth of the length of the body: the hind-shanks are dark yellow.

3rd var. The fore-chest is olive-colour: the head and a row of short bands on the abdomen are dark olive: the nectaries are also olive.

4th var. Pale green: the head, the chest, and the tip of the abdomen are pale yellow: the feelers are pale yellow; the tips of some of the joints are black: the legs are also pale yellow; the feet and the tips of the shanks are black.

5th var. Like the preceding, but with a lively green spot on the middle of the chest.

The winged male. It pairs with the oviparous female in November, and is black: the abdomen is yellowish brown with a row of black spots on each side: the feelers are rather thick till near their tips, and longer than the body; the fourth joint is much shorter than the third; the fifth is shorter than the fourth; the sixth is about one-third of the length of the fifth; the seventh is

usually longer, but sometimes a little shorter than the third: the mouth is yellow with a black tip: the nectaries are black, and nearly one-fourth of the length of the body: the legs are black; the fore-thighs from the base to the middle, the other thighs at the base, and the shanks excepting their tips, are yellow: the wing-ribs are yellow; the wing-brands are pale brown; the veins are brown.

1st var. The abdomen is dark yellowish green; there is a row of short black bands along its back and a row of black spots on each side: the mouth is black, but yellow towards the base: the legs are black; the thighs are pale yellow at the base; the shanks excepting their tips are dark yellow.

The front is slightly convex: the feelers are seated on short stalks; the first joint is longer and more slender than the base which supports it; the second is shorter and much narrower than the first; the third is a little more slender than the second; the fourth is much shorter than the third; the fifth is shorter than the fourth; the sixth is about half the length of the fifth; the seventh is nearly as long as the third: the nectaries are spindle-shaped: the tip of the abdomen is compressed, and rather more than half the length of the nectaries: the fore-legs are much shorter than the hind-legs, whose shanks are slightly curved: the length of the furcations of the third vein is variable.

Variation in the wing-veins. The lower branch of the first fork of the third vein is wanting.

[To be continued.]

IX.—*Observations on Mr. M'Coy's description of the Tail of Diplopterus**. By SIR PHILIP DE MALPAS GREY EGERTON, Bart.

To the Editors of the Annals of Natural History.

GENTLEMEN,

I VENTURED to trespass on your columns in September last, to direct attention to what I considered an unfairness on the part of Mr. M'Coy towards my absent friend Professor Agassiz. In his reply to my observations Mr. M'Coy distinctly acknowledges the priority of Agassiz's observations, and allows that the knowledge of them "added considerably to the certainty which he felt of the correctness of the view he had put forward." The courtesy usually observed between investigators in a common field would have required this avowal to have been made in the first instance. Though tardy it is nevertheless complete. I re-

* Ann. and Mag. of Nat. Hist. Nov. 1848, p. 303.

gret to be again obliged to notice an omission no less unjust to Professor Agassiz. In the November Number of the 'Annals,' Mr. M'Coy, when treating of the tail of *Diplopterus*, says:—"M. Agassiz has described the species of this genus as having heterocercal tails," leaving it naturally to be inferred, that these fishes had the ordinary form of tail common to many of the older ganoids. He then proceeds to state, that so far from this being the case, "there is almost as great a development of fin-rays above as below the spinal prolongation." This form of tail, intermediate in appearance between the homocercal and heterocercal types, he proposes to style "diphycercal." The following passage from the 'Fossil Fishes of the Old Red Sandstone,' p. 54, shows how fairly! Agassiz's description has been stated by Mr. M'Coy in reference to this modification of the caudal fin:—"La caudale a une conformation des plus singulières. Il va sans dire qu'elle est hétérocerque, et que la masse principale des rayons est insérée sous le prolongement relevé de la colonne vertébrale; mais au bord supérieure il y a au lieu de fulcres de véritables rayons, en grande quantité, si bien que le prolongement de la colonne vertébrale se trouve garni de rayons en haut comme en bas." Fig. 1. of tab. 18 gives a very good representation of the peculiarity described in the text. Now although the more perfect specimens examined by Mr. M'Coy may have enabled him to trace this modification to a greater extent, yet, in all fairness, he ought to have alluded to the facts established by Agassiz in the passage quoted above. I prefer again to attribute this seeming unfairness to forgetfulness of Agassiz's writings, rather than to intentional disregard of them, an opinion which is strengthened by the occurrence in Mr. M'Coy's writings of the cancelled specific appellation *latus*, when speaking of *Coccoosteus decipiens*. The remarks on the gradations of structure between the two types of tail, appended in a note to Mr. M'Coy's paper, and stated to have been *also* noticed by Müller, were made by the Professor so long ago as 1844, so that his claim to priority and not only to simultaneity of discovery is unquestionable. In conclusion, I must beg to disclaim any the slightest intention of giving annoyance to Mr. M'Coy, or of underrating in any degree the value of his ichthyologic investigations. I am only anxious that justice should be done to those who through absence are unable to vindicate their own rights until it may be too late to do so with effect.

I have the honour to be, Gentlemen, your obedient servant,
 PHILIP DE MALPAS GREY EGERTON.

BIBLIOGRAPHICAL NOTICES.

An Introduction to Botany. By J. LINDLEY, Ph.D., F.R.S. Fourth Edition, with Corrections and numerous Additions.

DR. LINDLEY's well-known Manual now makes its appearance in two considerable volumes, another proof, if such were wanting, of the increasing interest for botany in this country. This edition may almost be regarded as a new work compared with its predecessors, little remaining unaltered but the plan and illustrations, its principal value arising from its containing a carefully collected mass of quotations from almost all the more important memoirs and reports published during the interval since the former edition was printed.

Under these circumstances, we have to speak of the execution of the work more than of original subject-matter, and to indicate the manner in which the author has dealt with his materials.

In the first place must be mentioned with all praise the extremely lucid manner in which Dr. Lindley realizes and expresses the various doctrines he has to communicate; we have, probably, few scientific writers who excel him in this respect.

With regard to the first part of the work, treating of elementary structure, the recent investigations on the subject are very fully given in the form of extracts from our own pages, the Ray reports and similar sources. We may notice one error retained from the former edition, affirming what would be a strange anomaly if correct, viz. (i. p. 142) the quotation from the '*Ann. des Sc.*,' that *Nerium Oleander* and other plants have cavities in the cuticle in lieu of stomates; the fact being that the stomates are situated in the walls of cavities in the leaves.

At page 266 (vol. i.) Dr. Lindley states that he does not see how Schleiden's views "affect the distinction stated to exist between Exogens and Endogens, or offer any valid objection to the employment of those terms." Now it is or should be a canon in terminology that one word should have only one meaning, and since those two words, Exogens and Endogens, have been used to express a distinction mistakenly assumed to exist, to retain and apply them on different grounds is surely inadmissible. To exogenous growth as existing in Dicotyledons, there is no corresponding or rather opposite process in Monocotyledons, to allow of the antithetical term, endogenous growth, the growth of Monocotyledons differing from that of the first year of Dicotyledons in points not at all contemplated by the author of the expressions in question.

In vol. ii. p. 82 *et seq.* we have a long discussion on the questions whether flowerless plants have sexes or seeds. Dr. Lindley is not inclined to admit their existence, but he concedes the idea of sexuality in the view taken by Mr. Thwaites; on the ground that "it is not so much the mere presence of sexes, or of a mysterious sexual essence, that is denied, as that the organs called sexual in flowerless plants are of the same, or a similar, nature as those known to be sexes in the higher orders." It seems to us that this is rather a

distinction without a difference. If we understand Mr. Thwaites's ideas correctly, he regards, in the case of simple conjugation for instance, one cell as the homologue of the pollen-grain, the other of the germinal vesicle of a flowering plant. The modifications of the envelopes of these essential elements are of no consequence as to the general theory. At the same time we agree with Dr. Lindley that the balance of evidence lies against the doctrine of sexuality in the flowerless plants. The unconfirmed statements of Schleiden on the fertilization in the Marsileaceæ are not alluded to; the analogy of the larger spores to ovules has certainly been satisfactorily shown, by the subsequent observations of Mettenius and Nägeli.

We were rather surprised to find (at p. 136. vol. ii.) a repetition of the old statement, that the old bark and the wood, of Dicotyledons, are separated in spring by the exudation of a slimy substance called cambium; we should have thought this an oversight had it not also occurred in the first volume; any one may convince himself that there is no solution of continuity by submitting a section to the microscope, but this section requires care and a very sharp knife.

There are other minute points which might be noticed; but looking at the work as a whole, and the fullness and especial clearness with which the multifarious questions are expounded, this would be an invidious task; and we feel that the work must be received as a most welcome contribution, not only by advanced students, but particularly by all now on the threshold of the science, who have indeed great facilities compared with those who date their first acquaintance with botany from but a few years back.

Narrative of an Expedition into Central Australia during the years 1844-5 & 6, &c., by Captain CHARLES STURT, F.L.S.: with a Botanical Appendix by ROBERT BROWN, D.C.L., F.R.S., F.L.S., and Ornithological Notices by JOHN GOULD, F.R.S.

'This is not the place to give an account of the geographical results of this last expedition of "the father of geographical research;" if it were, we should be tempted to linger among its pages.

In this book the usually dreary and almost hopelessly depressing inland tracts of Australia are described by one, who has made them his home for many a weary month, in a way which reminds us of the narratives of the Arctic discoverers, Parry, Franklin, Richardson, Back and Buchan, or the antarctic voyage described by Ross and Hooker and M'Cormick. In their pages, such incidents as a white fox or little *Mus leucopus* visiting the icebound ships, a little marmot coming into a tent and snuggling, from the winter's blast, beside the fire, regardless of the sleeping terrier—the purple saxifrage (*S. oppositifolia*) creeping as it were out of the snow, the *Ledum palustre*, Cranberry, exquisite *Dryas octopetala*, *Oxyria*, and not a few *Ranunculi*—"icy" and "hairy," springing as if by magic out of the ground immediately when the snow has melted on some little favoured spot—*tell* in a way that can only be understood and enjoyed by the naturalist or the poet.

In like manner those precursors of civilization (to go no further back), Flinders, Oxley, Grey, Mitchell, Leichardt and Sturt, find in the desert not a few favoured spots; Australia has its *Eremocharis* (what a happy name!), its flights of parrakeets, its little gorgeous Maluri, its bronze-winged and crested pigeons, their wings "sprinkled with liquid gold," its rock kangaroos, its pretty *Tarsipes* *Spenserae*, its even more curious *Myrmecobius*, and insects as bright as its *Buprestidæ*, or as dull and curious as its species of *Helæus*. In the book before us, Capt. Sturt's narrative is made interesting by the numerous descriptions of the habits of the animals he and his party met with; while in the appendix, contributed by Mr. Gould and Dr. Robert Brown, are curious, and, owing to the novelty of the plants, valuable additions to our knowledge of Australian natural history.

It is seldom now that we or any one else have to refer to recent works of Dr. Brown—the most distinguished botanist of this or any other country,—and it is pleasing to see him again in the field where so many of his early discovered flowers are blooming. The author of the 'Prodromus Floræ Novæ Hollandiæ' has added a botanical appendix to his friend Capt. Sturt's book—an appendix which of itself will make the book valuable to the scientific man.

Capt. Sturt's collection consisted of about 100 species, with many other plants, chiefly trees, not easily determinable, and alluded to in his interesting narrative. The Captain and his companion Mr. Browne (the name was a good one for Australian botany), "seem," as Dr. Robert Brown informs us in his appendix, "to have collected chiefly those plants that appeared to them new or striking," and of such the collection contains a considerable proportion.

The new genera and species recorded are—

BLENNODIA, a genus of *Cruciferae* allied to *Matthiola*, but differing in having incumbent cotyledons, and in the mucous covering of the seeds; the species is *Blennodia canescens*.

STURTIA, a genus of *Malvaceæ* nearly related to *Gossypium* and *Senra*; the species *Sturtia Gossypioides* was found by the enterprising man with whose name it is associated, in the beds of the creeks on the Barrier Range.

Tribulus hystrix and *T. occidentalis* from the W. coast of Australia, the latter found during the voyage of the Beagle.

TRIBULOPIS, a new genus allied to *Tribulus*, and containing three species here shortly characterized: *T. Solandri*, found by Banks and Solander in 1770 near Endeavour River; *T. angustifolia* on the shore at the top of the Gulf of Carpentaria, where it was discovered by Mr. Brown on Flinders's expedition in 1802 and 1803; and *T. pentandra*.

Crotalaria Sturtii and *C. Cunninghami*.

Clanthus Dampieri; the synonyma are given and remarks, some from Cunningham's MS. Journal.

CLIDANTHERA, n. g.; perhaps near *Psoralea*, but differing in the unusual dehiscence of the anthers. The species is named *Clidanthera Psoralioides*.

Swainsona grandiflora, *S. Greyana*, *S. ? laxa*.

PENTADYMIS, n. g. of Labiate plants; *P. incana*.

Cassia Sturtii, *C. canaliculata*, *C. eremophila*, Cunningh. MSS., *C. platypoda*, *C. phyllodinea*.

PETALOSTYLIS, a new genus of *Cæsalpineæ* very near *Labichea*; the species is named *Petalostylis Labicheoides*.

PODOCOMA, a genus distinguished from *Erigeron* particularly by its stipitate pappus. The only species yet known is *Podocoma cuneifolia*.

LEICHARDTIA, a genus named after Dr. Leichardt, among the most enterprising of Australian explorers, whose narrative has been for two years before the public; the compliment of Mr. Brown will prove in the eyes of all botanists one even more graceful than the deserved one of the medal of the Royal Geographical Society of London awarded to him in 1846.

The species *Leichardtia australis* was originally found by Sir T. Mitchell, but with fruit only, in one of his journeys, and also in his last expedition, where it is mentioned (Trop. Austr. p. 85) as *Doubah*; the natives, we are informed by Sir Thomas, eat the seed-vessel entire, preferring it roasted. Captain Sturt observes, that the natives of the districts where he found it eat only the pulpy seed-vessel, rejecting the seeds.

Jasminum lineare, Brown, Prodr. i. 521, is a very generally distributed Australian species. Dr. Lindley has, according to our author, made of a very slight variety of it, his species *Jasminum Mitchellii* (Lindley in Mitchell's Trop. Austr. p. 365).

Jasminum micranthum, n. s.

Goodenia cycloptera, n. s.

Scævola depauperata, n. s. "In salt-ground in lat. 26° S."

Eremophila Cunninghamii; *Eremodendron C.*, DeCandolle, Prod. xi. 713; Deless. Ic. Sel. v. 43. t. 100, where there is an error in the number of the ovules. Our author gives an analysis of the five species, describing a new one.

Eremophila Sturtii. We may remark, that a genus of Desert-loving Egyptian and Arabian *Mantidæ* is named *Eremiaphila*. The slight difference of spelling and sound, as well as the total distinction of the subjects, ought to prevent any change of name. Insects and plants are sufficiently well-marked without the mere alteration of a sound.

Stenochilus longifolius, Br. Prod. i. 517, is identical with the recently described *S. pubiflorus* and *salicinus*. The same remark that applied to the name of the last genus applies to this. Amongst the Coleoptera there is a well-marked genus *Stenocheila*, described by Prof. Lacordaire; there is no danger of an entomologist without this beautiful carabidous form, finding some day an Australian plant sent him by a correspondent in place of an insect desideratum to his cabinet.

Grevillea (Eugrevillea) Sturtii, n. s.

Grevillea Mitchellii, Hooker, Mitchell's Trop. Austr. p. 265, proves to be *G. chrysodendron*, Br. Prod. Fl. N. Holl. 379, the name being

given, "not from the colour of the under surface of the leaves, which is nearly white, but from the numerous orange-coloured racemes rendering this tree conspicuous at a great distance."

Grevillea (Plagiopoda) neglecta, n. s.

Grevillea (Cycloptera) lineata, n. s. near *G. striata*.

Ptilotus latifolius, n. s. A similar remark might be made on this generic name to those two already given.

Neurachne paradoxa, n. s.

We have dwelt on this paper at greater length than usual, for in it are far more than "veteris vestigia flammæ." We extract an interesting passage supplemental to some observations of Dr. Brown's published in 1814 in the Botanical Appendix to Captain Flinders's Voyage.

"From the knowledge I then had of New Holland, or Australian vegetation, I stated that its chief peculiarities existed in the greatest degree in a parallel included between 33° and 35° S. lat., which I therefore called the principal parallel, but that these peculiarities or characteristic tribes were found chiefly at its western and eastern extremities, being remarkably diminished in that intermediate portion included between 133° and 138° E. long. These observations related entirely to the shores of Australia, its interior being at that period altogether unknown; and the species of Australian plants with which I was then acquainted did not exceed 4200. Since that time great additions have been made to the number, chiefly by Mr. Allan Cunningham, in his various journeys from Port Jackson, and on the shores of the north and north-west coasts during the voyages of Captain King, whom he accompanied; by Messrs. William Baxter, James Drummond, and M. Preiss, at the western extremity of the principal parallel; and by Mr. Ronald Gunn, in Van Diemen's Land. It is probable that I may be considered as underrating these additions, when I venture to state them as only between two and three thousand, and that the whole number of Australian plants at present known does not exceed, but rather falls short of, 7000 species.

"These additions, whatever their amount may be, confirm my original statement respecting the distribution of the characteristic tribes of the New Holland flora; some additional breadth might perhaps be given to the principal parallel, and the extent of the peculiar families may now be stated as much greater at or near its western than at its eastern extremity.

"With the vegetation of the extra-tropical interior of Australia, we are now in some degree acquainted, chiefly from the collections formed by the late Mr. Allan Cunningham, and Charles Fraser, in Oxley's two expeditions from Port Jackson into the western interior, in 1817 and 1818; from Captain Sturt's early expeditions, in which the rivers Darling, Murrumbidgee, and Murray, were discovered; from those of Sir Thomas Mitchell, who never failed to form extensive collections of plants of the regions he visited; and lastly, from Captain Sturt's present collection.

"The whole number of plants collected in these various expeditions may be estimated at about 700 or 750 species; and the gene-

ral character of the vegetation, especially of the extensive sterile regions, very nearly resembles that of the heads of the two great inlets of the south coast, particularly that of Spencer's Gulf, the same or a still greater diminution of the characteristic tribes of the general Australian flora being observable. Of these characteristic tribes, hardly any considerable proportion is found, except of *Eucalyptus*, and even that genus seems to be much reduced in the number of species; of the leafless *Acaciæ*, which appear to exist in nearly their usual proportion; and of *Callitris* and *Casuarina*. The extensive families of *Epacrideæ*, *Stylideæ*, *Restiaceæ*, and the tribe of Decandrous *Papilionaceæ*, hardly exist, and the still more characteristic and extensive family of *Proteaceæ* is reduced to a few species of *Grevillea*, *Hakea*, and *Persoonia*.

"Nor are there any extensive families peculiar to these regions; the only characteristic tribes being that small section of aphyllous, or nearly aphyllous *Cassiæ*, which I have particularly adverted to in my account of some of the species belonging to Captain Sturt's collection, and several genera of *Myoporinæ*, particularly *Eremophila* and *Stenochilus*. Both these tribes appear to be confined to the interior, or to the two great gulfs of the south coast, which may be termed the outlets or direct continuation of the southern interior; several of the species observed at the head of Spencer's Gulf also existing in nearly the same meridian, several degrees to the northward. It is not a little remarkable that nearly the same general character of vegetation appears to exist in the sterile islands of Dampier's Archipelago, on the north-west coast, where even some of the species which probably exist through the whole of the southern interior are found; of these the most striking instances are, *Clianthus Dampieri* and *Jasminum lineare*, and to establish this extensive range of these two species was my object in entering so minutely into their history in the preceding account.

"A still greater reduction of the peculiarities of New Holland vegetation takes place in the islands of the south coast."

Of zoological productions, as far as birds are concerned, Mr. Gould informed Captain Sturt that the *Cinclosoma cinnamomeus*, Gould, beautifully figured by Messrs. Gould and Richter in vol. ii., was the only new one found during his expedition; but the Captain evidently, though a close observer and accurate recorder of the habits of animals, had no facilities, in the usually desert tracts he passed over, to preserve skins and specimens, except of plants, easily brought within a few sheets of paper: where shrubs are found there will be birds, and where plants and animals can live many insects will find a home; we should like to see some of the insect inhabitants of the regions Captain Sturt passed through.

The figures of the *Milvus affinis*, and the truly exquisite plate of *Pigeons*, and also that of the *Mus conditor*, convince us that if Mr. Gould, like Mr. Audubon, were to publish, in parts, a reduced size (say largish octavo) of such works as his truly national *Birds of Europe* and *Birds of Australia*, such a series of volumes would find an entrance where his larger works could never be seen: the co-

loured figures in the book before us prove that reduced representations when carefully done and *coloured* (as these figures are) are more useful to the scientific man than large folio volumes, however gorgeous and magnificent.

In Germany, his fine work on the *Ramphastidæ* has been copied on a reduced scale; it is a pity that so spirited and talented a man should not have all the results of the profit of such books.—A. W.

Arran and Excursions to Arran, with reference to the Natural History of the Island. By the Rev. DAVID LANDSBOROUGH. 1847. Johnstone.

This excellent work should have been printed without its prefatory matter, and it would have been noticed by us earlier, but for the difficulty we felt about referring to a poem in a scientific Journal. The poem of Arran however only occupies 80 pages of a book of 367 pages, so that the gifted and amiable author of it should have published the poem separate, and the excursions separate, or at least given the prominence and *preface* to the larger and (to us) more valuable portion of his book. In a future number we intend to give some extracts from these very interesting excursions, which will show such as are not acquainted with them, that they have another "Journal of a Naturalist," and a decidedly originally-treated natural history of Arran, which would have delighted Gilbert White of Selborne. With the works of the Rev. D. Landsborough and the geological and picturesque descriptions of Professor Ramsay, Arran, the Queen of Scotland's Islands, behind "whose northern battlement of hills" we have witnessed more than one glorious sunset, the visitor will find most excellent guides. We have tested them both; they should be printed in one volume.—A. W.

PROCEEDINGS OF LEARNED SOCIETIES.

BOTANICAL SOCIETY OF EDINBURGH.

Nov. 9, 1848.—The Rev. Dr. Fleming, President, in the Chair.

The President opened the meeting by making a few observations on the flourishing state of the Society. He alluded to the interesting communications which had been read during the past session, many of which had been published in the Society's Transactions; and concluded by expressing a hope that the ensuing session might be equally prosperous.

Numerous donations to the Museum and Library were announced, and thanks ordered to be returned for them.

The following communications were read:—

1. "Algæ Orientales, or Descriptions of new species belonging to the genus *Sargassum*" (part 3), by R. K. Greville, LL.D. (Ann. Nat. Hist. vol. ii. S. 2. p. 431.)
2. "Stirpes Cryptogamæ Sarnienses, or Contributions towards the

Cryptogamic Flora of Guernsey," by the Rev. T. Salwey. (See p. 22 of the present Number.)

3. "Notice of the occurrence of *Anacharis Alsinastrum* (Bab.) in the river Leen near Nottingham," by James Mitchell, M.D.

The author states that he first noticed the plant in the muddy river Leen which runs through the meadows near Nottingham in September 1848, and that more recently he has seen it in enormous masses in that stream and in more or less quantity in "every ditch in the meadows," and says that "it has certainly not been introduced" there. He has not yet noticed the flowers. [The Rev. A. Bloxam informs us that it has recently been found by Mr. Kirk of Coventry in another new locality; viz. in the four reservoirs attached to the Watford Locks near Crick in Northamptonshire.—ED. ANNALS.]

4. Dr. Balfour read a letter from Dr. George Johnston of Berwick, in which he notices the discovery of the *Anacharis Alsinastrum* in a truly wild locality in the bed of the Whittadder. He also read extracts from a letter from Mr. Babington, stating that he possesses a specimen of the same plant sent to him in July 1842, by Dr. Johnston, from a pond at Dunse Castle in Berwickshire; the specimen was sent at that time as being a plant new to Dr. Johnston, but from the want of flower or fruit it was not then determined and subsequently mislaid.

5. "Note on the Colour of a Freshwater Loch," by George Dickie, M.D. See p. 20 of the present Number.

December 14.—The Rev. Dr. Fleming, President, in the Chair.

Before proceeding to the business of the meeting, it was unanimously resolved, that the Society should record the loss which botany and horticulture had sustained in the death of Mr. William M'Nab, Superintendent of the Royal Botanical Garden of Edinburgh. Long and ardently devoted to the cultivation of plants, Mr. M'Nab had carefully observed the influence of particular treatment on their evolution, and had acquired very distinct conceptions of the nature and limits of variation, and the conditions of healthy vegetation. To a profound technical and practical knowledge of his profession he added a frankness in imparting his information, conjoined with a correct view of his social position, and a singleness and modesty of character by which he secured a rare amount of respect and esteem.

The following communications were read:—

1. "Algæ Orientales, or Descriptions of new species belonging to the genus *Sargassum*" (part 4), by R. K. Greville, LL.D.

The paper was illustrated by drawings of each species, and will appear in the 'Annals of Natural History' and in the Society's Transactions.

2. "On certain Glandular Bodies occurring in the Epidermis of Plants," by Charles Murchison, Esq. Mr. Murchison stated that the bodies under consideration consist of nucleated cells of various forms, often divided by partitions, and containing oily and granular matter. In describing them he noticed—1st, Their structure, form,

and distribution; 2nd, The action of chemical re-agents on them; and 3rd, Their development. He mentioned their occurrence in *Aloysia citriodora*, where they exist in the form of a transparent circular membrane, with a central dark spot or nucleus; in various *Labiatae*, including species of *Thymus*, *Mentha*, *Ballota*, *Melissa*, *Lavandula*, *Marrubium*, *Leonurus*, *Teucrium*, *Sideritis*, *Hyssopus* and *Origanum*, in which they appear in the form of a transparent parent-cell, including a circular body about 1-600th of an inch in diameter, which is divided into four by a crucial septum, and in some cases subdivided further, so as to give twelve compartments—four in the centre and eight in the circumference, disposed in a circular manner.

The author next considered these bodies as they occur in the Lilac (*Syringa vulgaris*), *Tecoma australis*, *Myrica conifera* and *serrata*.

He stated that their contents are usually of an oily nature, being soluble in æther, but insoluble in water. They are developed in the same way as cells in general, the nucleus splitting into two cells, and each of these into two others, and so on. In all these bodies there are four primary compartments, which are often subdivided into eight, twelve, or more. This division into four resembles what takes place in pollen grains, and in the spores of many Cryptogamic plants, as *Lycopodium*, *Sphagnum*, and various algæ.

From the form and structure of these bodies, taken in connection with their contents, and the manner in which they can be detached and separated from the cuticle, the author concludes that they are of a glandular nature. The paper was illustrated by coloured etchings.

Mr. Sanderson called attention to some forms of abortive hairs, as represented by Raspail, and suggested that the bodies observed by Mr. Murchison might be of the same nature.

3. "On the mode of growth of *Oscillatoria* and allied genera," by John Ralfs, Esq., Penzance. (See p. 39 of the present Number.)

Professor Balfour was elected President for the ensuing year.

Professor Christison, Dr. Neill, Rev. Dr. Fleming, and Professor Goodsir, were elected Vice-Presidents.

William Brand, Esq., Treasurer, and Dr. Greville, Secretary.

ROYAL PHYSICAL SOCIETY OF EDINBURGH.

The monthly meeting of this Society took place in the Institution Rooms, 6 York Place, on the evening of Wednesday last, when Dr. Greville occupied the chair, and there was a full attendance of members and visitors. The first communication was from Mr. Hugh Miller regarding the *Asterolepis*, and other allied genera of fossil fishes from the Old Red Sandstone, illustrated by a beautiful set of specimens and casts, revealing the structure and œconomy of these ancient Ganoids, and the relation they bear to their congeners of the present day. Mr. Miller mentioned that several large specimens of the *Asterolepis* had been found in Russia by Professor Asmus, of the University of Dorpat, and in the north and west of Caithness by Mr. Robert Dick of Thurso. The Caithness specimens, he said, though not altogether so gigantic as those of Russia, were in a greatly finer

state of keeping, and furnished a better basis for the restoration of the animal. Its head was covered with strong dermal plates of bone, fretted on the exterior surface by the star-like tubercles to which the creature owed its name; its jaws were furnished by a thickly-set outer row of *fish* teeth, and an inner thinly-set row of huge *reptile* teeth; a single plate of vast size protected the under part of the head, filling up the arch-shaped space formed by the semicircular sweep of the lower jaw; its gill-covers, like those of the sturgeon, were composed each of a single plate;—like a contemporary fish of the same family, the *Glyptolepis*, it had a strong shoulder-bone (the analogue in fishes of the *os humerus* in quadrupeds and the human subject), and its body was covered with delicately fretted scales intermediate in their style of carving between those of the *Holoptychius* and *Glyptolepis*. The true skull of the animal was apparently a mere cartilaginous box, of which no fragment survives, but in the exterior cranial plates there might be traced what seemed to be analogues of the frontal-superior, frontal-anterior, and parietal bones. The eye orbits were placed, as in many of its contemporaries, immediately over the upper jaw; and, as in *Coccosteus*, *Diplopterus*, and *Osteolepis*, a small well-marked plate occupied the centre of the space between. The external lines of the frontal buckler did not always indicate lines of suture, but in some cases seemed purely ornamental; and the *reptile* teeth of the creature, as, in the absence of specimens establishing the point, had been shrewdly anticipated by Agassiz, indicated the true *Dendrodic* character. One very curious bone, which had its place probably over the shoulder, greatly resembled the dorsal spine of one of the huger Placoids of the Carboniferous system,—the *Gyracanthus*; it was similarly furrowed by diagonal groovings; but notwithstanding the resemblance, it was evidently not an ichthyodolite, but lay flat on the body of the creature in the character of a plate. As shown by numerous coprolites found in the same bed with the remains of *Asterolepis*, and which, from their great size, could have belonged to none of its contemporaries, the animal had possessed, like existing sharks and rays, and some of the extinct Enaiosaurians, the spiral disposition of intestine; and the broken fragments of scales of *Dipterus*, palpably present in their convolutions, demonstrated, what might, indeed, be inferred from its formidable teeth, carnivorous habits. Mr. Miller stated that the bulk of some of the individuals of this genus must have been enormous; and he was the more desirous, he said, to draw attention to the fact, as he had mentioned in his little work on the Old Red Sandstone, founding on a large amount of negative evidence, that the fishes of the Lower Old Red Sandstone were characterized generally by a mediocrity of size. Single occipital plates found by Mr. Dick, in the neighbourhood of Thurso, measured sixteen and a half inches, and a corresponding plate, in the collection of Professor Asmus, at Dorpat, two feet across; whereas in the very massive specimen of *Holoptychius*, found by the Rev. Mr. Noble of St. Madoes, at Clashbennie, and now in the British Museum, the two plates by which this single plate of the *Asterolepis* is represented, measure only four and a half inches. Mr.

Miller acknowledged to the Society his great obligations to Mr. Dick, a singularly intelligent tradesman of Thurso, to whose geological labours, prosecuted in his leisure hours, Mr. Miller mainly owed his acquaintance with this gigantic Ganoid, and who had kindly made over to him the interesting fossils now before them, illustrative of its form and character.

At the conclusion of Mr. Miller's paper several members spoke of the interesting nature of his researches, and the desirableness of those engaged in the study of palæontology exerting themselves to have in Edinburgh a public collection of fossils, in which our city is so deficient. An interesting discussion also took place, principally bearing on the relation existing between the fossil fauna and flora of ancient epochs and those of the recent æra, when some interesting facts were stated by several members, which it is hoped will be brought forward at a future meeting.

Mr. R. Stark then exhibited to the meeting a few specimens of mosses recently received from North America, and lichens from the Falkland Islands. Among the former were fine specimens of *Bryum roseum*, a large and beautiful species, with mature fruit, *Neckera minor*, Pal. Beauv., and *Anomodon viticulosum*, B. Auct., which is confined to North America. These, and the other species shown, illustrated the modifications produced by the difference of climate and other influences on them, as well as plants of a higher order common to the European and American continent. The lichens from the Falkland Islands, brought home by Dr. J. Hooker, were mostly of species closely allied to or identical with those of Britain. One of the most interesting was a minute species—*Squamaria elegans*—which may be regarded as the most southerly plant known, being found alone on the bleak and desolate southern coast of Cockburn's Island, beyond which all traces of vegetation disappear. Mr. Stark concluded by a few remarks on the desirableness of more fully investigating the geographical range of these plants, with a view of illustrating other branches of natural history.

ZOOLOGICAL SOCIETY.

Feb. 22, 1848.—William Yarrell, Esq., Vice-President, in the Chair.

The following paper was read :—

1. ON A NEW SPECIES OF CHIMPANZEE. BY PROFESSOR OWEN, F.R.S.

This communication contained a description of the skulls of adult and aged male and female Chimpanzees from the Gaboon river, west coast of Africa, much exceeding in size and specifically distinct from the previously known *Troglodytes niger*. The author proposed to call the new species *Troglodytes Savagei*, after Dr. Thos. S. Savage, by whom it had been discovered and its existence made known to Professor Owen, in a letter dated April 24th, 1847, and of which the following extract was read :—

Ann. & Mag. N. Hist. Ser. 2. Vol. iii.

“Protestant Mission-House,
Gaboon River, West Africa,
April 24, 1847.

“My dear Sir,

“Your known interest in the Zoology of Africa will find a ready excuse I trust for the following communication, and lead you, in the midst of various engagements, to give me a few moments in reply. I am on my way to the United States in a vessel which, to complete its voyage, had to touch at this point. I find it a region rich and untried in all the departments of Natural History, besides being full of interest in a far more important point of view, that of a missionary field. I have found the existence of an animal of an extraordinary character in this locality, and which I have reason to believe is unknown to the naturalist. As yet I have been unable to obtain more than a part of a skeleton. It belongs to the *Simiadae*, and is closely allied to the Orangs proper. It reaches nearly if not quite the height of five feet in the adult state and is of a large size. I am considerably in doubt in regard to its identity with an animal said to have been known to Buffon as a large species of orang-utan, under the name of Pongo. It is referred to in a note on the 58th page of the first volume of the American edition of Cuvier's ‘Règne Animal,’ where he asserts that Pongo is a corruption of Boggo, which is given in Africa to the chimpanzee or to the mandrill, and was applied by Buffon to a pretended large species of orang-utan, the mere imaginary product of his combinations. Then he says that Wurmb, a naturalist of Batavia, transferred the name (Pongo) to a monkey in Borneo, which he thinks identical with *Pithecus Satyrus* (the real orang-utan, a red orang of Asia).

“My excellent friend, the Rev. J. L. Wilson, missionary of the Am. Bd. of Comm. For. Missions to this part of Africa, thinks that Pongo comes from ‘Mpongive,’ the name of the tribe, and consequently the region, on the banks of the Gaboon river near its mouth, among which tribe he has resided for about five years. The tribe once extended a great distance on the coast above and below the river Gaboon, and the languages spoken for a great distance both above and below are evidently but dialects, with the Mpongive, of one language. Whence Buffon professed to receive his specimen of ‘large species of orang-utan’ I know not; but this region and its vicinity indefinitely are the only points at which, so far as I can ascertain, ‘a large species of orang-utan’ has been heard of except the chimpanzee, which is now well-known. I have seen it mentioned that the skeleton of the Pongo of Borneo is in the Royal College of Surgeons, of which Institution you are a Professor. Now may I solicit your aid in this matter? I will send you outlines of the skull of the male and female (adults), and ask the favour of a reply to my letter, stating whether you can identify them with that of any animal you know of under the name of Pongo, or any other cognomen. I have no correspondent in Paris; if you feel sufficient interest in the subject, will you do me the favour to ascertain from that city the fact whether such skulls exist in any cabinet there? The natives state that a young one was caught

many years ago and sold to a French captain who never returned, and that it was the only individual taken out of the river. From what I know, the young skull would very much resemble that of the chimpanzee. I have four crania (two male and two female), with many bones, though not a perfect skeleton; but I hope to complete one before I leave the river, and to procure a dead subject, which I shall preserve in spirits. Great uncertainty however attends my success, as they are indescribably fierce and dangerous, and are found only far in the interior; they are killed by elephant-hunters only in self-defence.

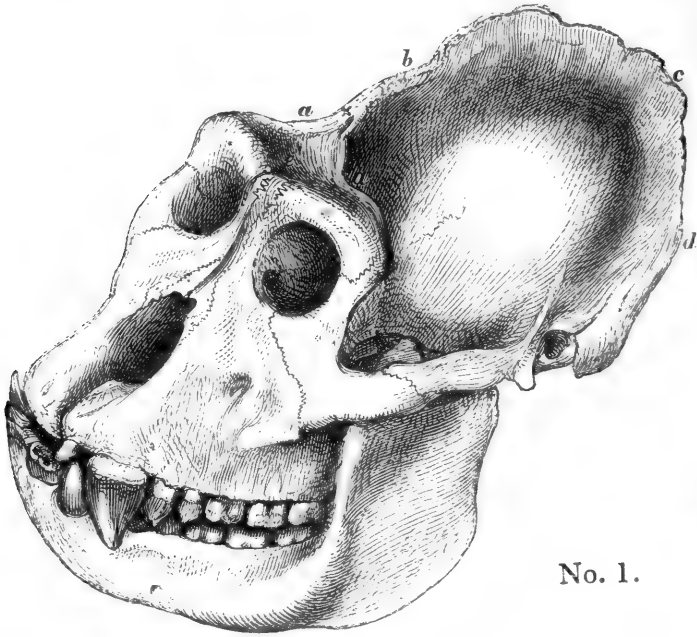
"Below you have a sketch of the cranium of the male (No. 1) and female (No. 2), executed for me by Mrs. Prince, the wife of Dr. Prince, the English Baptist Missionary at Fernando Po, who is here for a short time in search of health. *a, a* are two low ridges converging as seen in the sketch, and uniting at *x*, and forming a strong prominent ridge in the course of the sagittal suture, which comes into a junction with a lateral ridge, *d*, sent back from the petrous portion of such temporal bone; *e* is a strong fossa of triangular shape between the ridges *a, a*. The space between the zygoma and temporal bone in a transverse direction is $1\frac{3}{4}$ inch deep; the diameter from before backwards 3 inches; at *b* is a sinus about half an inch in depth and an inch in length, with foramina for the passage of blood-vessels and nerves. The two upper middle incisor teeth are absent, but their sockets show their size to have been nearly if not quite double the two outer ones. The two lower middle incisor teeth are narrower than the two outer.

"The female cranium is a full-grown one, but differing from the male in the prominence of the ridges, the two anterior corresponding to *a, a* in the male, and the central are rudimental only, except at the extremes of the latter where it joins the posterior transverse ridge, lettered *d* in the male. It has lost the two middle upper incisors, which bear the same relation in respect to size to the two outer that those of the male do. All the incisors both in the upper and lower jaw are larger than they are in the male. The canines in the female are shorter than in the male. These points are all that I need specify to enable you to identify the crania with any in your possession. You will greatly oblige me by a comparison, and communicating the result at your earliest convenience."

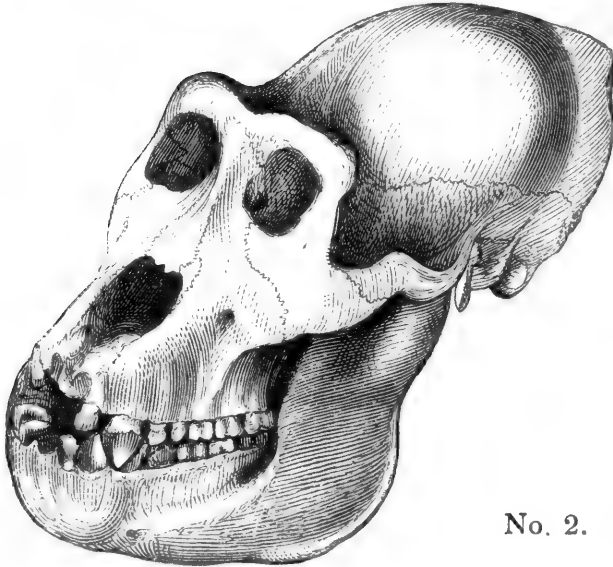
Professor Owen having, at the time when he received this information, observed in the cranium of a young but nearly adult *Troglodytes niger* that the canine teeth presented the same sexual superiority of development* as in the orang's (*Pithecus*), believed it possible that the marks of distinction mentioned by Dr. Savage might prove to be the fully developed characteristics of old and powerful males of the *Troglodytes niger*; and in the absence of means of making comparisons of other characters, besides superior size, longer and larger canine teeth, and concomitant strong sagittal and lambdoidal cristæ, he had deemed it better to communicate

* Odontography, pl. 118, 119, fig. 1.

these doubts to Dr. Savage, than to hazard a premature indication of a species, which might prove a sexual, or a local and stronger, variety of chimpanzee.



No. 1.



No. 2.

Mr. Samuel Stutchbury of Bristol, who had likewise received from Dr. Savage a similar announcement of the existence of a large and formidable species of chimpanzee in the Gaboon district, had requested some of the captains of vessels trading from Bristol to the Gaboon river to make inquiries respecting the species and en-

deavour to obtain specimens of it; and the result was that Captain George Wagstaff had succeeded in procuring at the Gaboon river, and had presented to Mr. Stutchbury, three skulls of the large species and one of the smaller species of chimpanzee, all adult: and these skulls Mr. Stutchbury had transmitted for description and exhibition at the Zoological Society.

One of the skulls of the large species (*Troglodytes Savagei*) was of a very old male: the length of the skull was $11\frac{1}{2}$ inches (0·29), with the molars worn nearly to the stumps, and the crown of the canine reduced, partly by fracture, partly by attrition, to its basal portion: its pulp had been inflamed and had produced ulceration of the alveolus.

A second skull was also of a male, of equal size, with the full dentition of maturity, but with merely the summits of the cusps of the molars and the margins of the incisors slightly worn. The third skull of the *Troglodytes Savagei* was of a female, 9 inches (0·23) long, with the mature dentition, and with the molars not more worn than in the younger male. The fourth skull was of a female adult chimpanzee, $7\frac{1}{4}$ inches (0·185) in length, of the known species (*Troglodytes niger*), with the complete permanent dentition, and the teeth more abraded than in the two preceding skulls.

The lower jaw was wanting in each of the foregoing specimens, and the occipital or basal part of the skull had been more or less fractured in each; the skull of the young but full-grown male of the *Troglodytes Savagei* being the most perfect.

Captain Wagstaff reached Bristol in a broken state of health, and died soon after his arrival. The only information which Mr. Stutchbury was able to obtain from him was, that the natives, when they succeed in killing one of these chimpanzees, make a 'fetish' of the cranium. The specimens bore indications of the sacred marks in broad red stripes crossed by a white stripe, of some pigment which could be washed off. Their superstitious reverence of these hideous remains of their formidable and dreaded enemy adds to the difficulty of obtaining specimens.

Besides the young but mature skull of the male *Troglodytes niger*, of which the permanent dentition was figured in the author's 'Odontography,' he had compared with Mr. Stutchbury's specimens of *Troglodytes Savagei*, a skull of a more aged male *Troglodytes niger* with the permanent dentition more worn than in the younger adult male of the *Troglodytes Savagei*. The results of a detailed comparison between the skulls of the adult males of the two species were then given. Besides the differences of size, as indicated in the subjoined 'Table of Dimensions,' the following were among the characters establishing the specific distinction of the two chimpanzees. With regard to the dentition, the author observed that, as in the smaller species of the Orangs of Borneo (*Pithecus Morio*), the incisive teeth of the smaller species of chimpanzee (*Troglodytes niger*) equalled in size those of the larger species (*Troglodytes Savagei*); but that the canines and the molars were considerably larger in the *Troglodytes Savagei*: the series of the five molar teeth

in this species occupy an extent of 2 inches $7\frac{1}{2}$ lines (0·068), whilst in *Troglodytes niger* their extent is only 1 inch $10\frac{1}{2}$ lines (0·048). The crown of the canine inclines more outwards in *Troglodytes Savagei*; the longitudinal convex ridge on its inner surface is more prominent, the anterior groove bounding that ridge being deeper in *Troglodytes Savagei* than in *Troglodytes niger*: the posterior inner groove is continued upon the root of the tooth in *Troglodytes Savagei*. The last molar is more nearly equal in size to the penultimate one, and is more complex in structure, than in *Troglodytes niger*; it has the posterior outer cusp and particularly the posterior inner cusp more developed, and it has distinctly the connecting cross ridge between the posterior outer and the anterior inner cusp, which ridge is not developed in the last molar of *Troglodytes niger*. The bony palate is longer in proportion to its breadth than in *Troglodytes niger*, in which the breadth of the palate between the canines is absolutely greater than in *Troglodytes Savagei*.

The external sutures between the premaxillary and maxillary bones, which disappear so early in the *Troglodytes niger*, are more or less persistent and traceable in all but the oldest male skull of the *Troglodytes Savagei*; these sutures show that after the premaxillary bone has entered the nose, of which it forms the lateral boundary of the external opening, it again appears upon the exterior surface of the face above the nostril, where its upper extremity forms a triangular or wedge-shaped flattened piece, interposed between the lower half of the *os nasi* and the *os maxillare superius*, thus excluding the latter bone from the boundary of the external nostril. One skull of a young *Troglodytes niger* with deciduous teeth in place, shows by the still persistent upper half of its facial suture, that it terminates in a point a little above the middle of the border of the external nostril, and that a portion of the superior maxillary is interposed between it and the nasal: in two other skulls of young *Troglodytes niger*, the slender pointed summits of the premaxillaries reach the nasals and exclude the maxillaries from the boundary of the nostril, but do not expand into triangular plates as in *Troglodytes Savagei*: in not any of the skulls of *Troglodytes niger* with the permanent dentition does any trace of the suture between the premaxillaries and maxillaries remain*.

The nasal bones of the *Troglodytes Savagei* also afforded a remarkable specific character: although the traces of their primary median division were obvious at their lower part, they had coalesced with each other as in the smaller species; but instead of being flat, or slightly and equably convex on the anterior surface, as in *Troglodytes niger*, they are produced forwards as they incline towards each other, along their upper half, and project there in the form of a slight bony longitudinal ridge, equally dividing the lower half of the interorbital space. This character—the nearest approach

* M. de Blainville, describing the osteology of the chimpanzee from a young specimen of the *Troglodytes niger*, says, "Mais les prémaxillaires, qui offrent la particularité de toucher à peine les os du nez et de souder de fort bon heure avec les maxillaires," &c. *Ostéographie*, fasc. i. p. 33.

to the prominent nasal bones of Man made by any known species of ape—is as well-marked in the female *Troglodytes Savagei* as in the male. The lower half of the coalesced nasals in *Troglodytes Savagei* is expanded and nearly flat, of an oval form, with the border forming the upper part of the nostril emarginate on each side of a median, sometimes bifid, point. Thus the lateral border of the nasal bone describes a strong sigmoid curve, convex outwards in its lower two-thirds, in *Troglodytes Savagei*; in the less expanded nasal bone of *Troglodytes niger* the same border is usually concave outwards, or very slightly convex outwards at the lower third; and the outer surface of the bone is flat or equably and very slightly convex. The greater breadth of the lower end of the nasal with the expansion of the upper ends of the premaxillaries, gives a different form to the external nostril in the *Troglodytes Savagei* to that which it presents in *Troglodytes niger*: in this it is ovate or cordate with the narrow end upwards; in the larger species it is a wide ellipsoid, almost as broad above as below.

The alveolar portion of the premaxillaries in *Troglodytes Savagei* was absolutely shorter than in *Troglodytes niger*, and therefore much shorter relatively, and to that extent the skull of the larger species is less 'prognathic.' The zygomatic processes were not only absolutely as well as relatively stronger and deeper than in *Troglodytes niger*, but differently shaped; the squamosal portion rising in an angular form in *Troglodytes Savagei*, and being as deep as the malar portion. The temporal fossæ are relatively as well as absolutely wider; for whilst the zygomatic arches are more expanded, the diameter of the intervening postorbital part of the cranium is the same in the male *Trogl. Savagei* as in the *Trogl. niger*. There is a distinct hemispheric mastoid process in the male *Troglodytes Savagei*. The speno-maxillary fissure is narrower and less bent in *Troglodytes Savagei* than in *Troglodytes niger*, in which it more nearly resembles that of Man. The supraorbital ridges were even proportionally more developed in the larger than in the smaller species of chimpanzee, and send down a vertical prominence to the root of the nasal bones. The outer and lower borders of the orbits, and the whole malar bones are more prominent and tumid, and, with the enormous sagittal and lambdoidal crests and zygomatic arches, give a scowling and diabolical physiognomy even to dry bones of the head of this most formidable of the great Anthropoid apes.

In the skull of the female of the *Troglodytes Savagei* in which the canine teeth show the same sexual inferiority of size as in the female *Troglodytes niger*, the molar teeth present the same superior degree of development and complexity, especially the last molar, as in the male of the larger species, and have demanded a concomitant increase of bulk of the temporal muscles; and consequently not only are the zygomatic arches relatively stronger, but the temporal ridges, instead of being separated as shown in an aged skull of the female *Troglodytes niger* in the museum of the College of Surgeons, by a smooth tract of more than an inch in breadth, come into contact at the beginning of the sagittal suture, and are so continued backwards with a narrow groove between them, to the lambdoidal crest.

The development of this crest also renders the supraoccipital surface almost flat in the female *Troglodytes Savagei*, and it is even concave in the great males; whilst in both adult males and females of the *Troglodytes niger* it is convex.

There are specific distinctions in the interior of the cranium of the two species: the olfactory (rhinencephalic) fossa closed by the cribriform plate, though very little wider, is considerably deeper in *Troglodytes Savagei* than in *Troglodytes niger*; and the 'crista galli,' which is small in *Troglodytes niger*, is absent in *Troglodytes Savagei*, nor is there any ridge continued from the fossa upon the inner surface of the frontal in the line of the frontal suture.

In *Troglodytes niger* there is a short *ala minor sphenoides* continued outwards from the anterior clinoid process, and the upper and outer angle of the foramen lacerum anterius is produced into a short cleft: in *Troglodytes Savagei* the rudiment of the *ala minor* terminates at the upper border of the foramen lacerum anterius, which has a subquadrate form, and is not extended outwards into an angular fissure. The *sella turcica* is relatively shallower in *Troglodytes Savagei* than in *Troglodytes niger*, in which it is shallower than in Man.

Many other minor differences were noted, but these would be better understood by the aid of the figures in the memoir. Some scepticism, the author observed, might be expected as to the alleged specific distinction of the large and small chimpanzees by naturalists who had not been able to realise the differences by actual comparison of the specimens; but Professor Owen felt no doubt that, as in the case of the *Pithecus Morio*, more extended knowledge of the new species would confirm the validity of its distinction from the *Troglodytes niger*.

The stronger zygomatic arches and the more developed sagittal and lambdoidal crests might be viewed as adaptive developments concomitant on the larger canines, and indicative of a larger and more powerful variety of chimpanzee; but the larger proportional molars and the smaller proportional incisors, the more equal and complex last molar tooth, together with the prominence—slight as it is—of the nasal bones at their median coalescence, their inferior expansion, and, above all, the reappearance of the premaxillaries by their expanded superior extremities upon the face above the nostril, are more than mere differences of size and proportion, and being repeated in both male and female adults of the great chimpanzee of Gaboon, leave no alternative, according to the value assigned to such characters in other Quadrumanous genera, than to pronounce the *Troglodytes Savagei* to be specifically distinct from the *Troglodytes niger*, and this to be, as the *Pithecus Morio* is to the *Pithecus Wurmbii* in Borneo, a smaller, feebler and more anthropoid species of the genus *Troglodytes* in Africa.

In conclusion, Prof. Owen remarked that he had proposed the name of the new species of Chimpanzee provisionally, for the convenience of its description and comparison; and that, should he be able to learn that its discoverer had given a name to it, he should adopt that name, of which *Troglodytes Savagei* would then be a synonym.

	<i>Troglodytes Savagei.</i>		<i>Troglodytes niger.</i>		<i>Simia Wurmbii.</i>	
	Adult Male.	Adult Female.	Adult Female.	Adult Male.	Adult Orang. Female.	Male.
	in. lin.	in. lin.	in. lin.	in. lin.	in. lin.	in. lin.
Length of the head from the <i>inion</i> , or posterior plane of the occiput, to the margin of the incisors	11 4	9 0*	7 6	8 0	8 6	10 6
Length of the head from the <i>inion</i> to the fronto-nasal suture	7 5	6 3	5 2	5 4	5 7	6 3
Length of the head from the fronto-nasal suture to the margin of the incisors ...	5 3	4 4	3 8	3 10	4 4	5 3
Transverse diameter of the <i>cranium</i> at the post-auditory ridges	6 10	5 6	4 9	5 1	4 8	5 8
Length of the smallest lateral diameter of the <i>cranium</i> behind the orbits	2 9	2 5	2 8	2 9	2 6	2 9
Length of the <i>os frontis</i>	4 3	3 7	2 9	2 10	3 0	3 6
Length of the sagittal suture	3 9	3 0	2 6	2 8	2 7	3 6
Distance between the temporal ridges	nil	nil	1 0	nil	0 6	nil
Diameter of the face at the zygomata	6 9	5 3	4 8	5 0	5 0	6 9
Length of the zygomatic <i>fossa</i>	2 10	2 0	1 9	1 11	2 0	2 6
Breadth of the zygomatic <i>fossa</i>	1 11	1 5	1 1½	1 4	1 5	1 10
Diameter of the face taken from the outside of the middle of the orbits	5 6	4 8	4 3	4 4	3 9	4 8
Interorbital space	1 3	1 1	0 7†	0 10	0 5	0 7
Lateral diameter of the orbit	1 9	1 6	1 4	1 5	1 4	1 6
Perpendicular diameter of the orbit	1 7	1 7	1 3	1 3	1 6½	1 7
Transverse diameter of the nasal aperture ..	1 2	1 2	1 0	1 0	1 1	1 0
Perpendicular diameter of the nasal aperture ..	1 5	1 3	1 1½	1 2	1 6	1 6
Distance between the infraorbital <i>foramina</i>	2 7	2 5	2 1	2 2	1 8	2 0
Breadth of the alveolar portion of the <i>maxilla superior</i>	3 1	2 7	2 4	2 6	2 8	3 2
Distance from the inferior margin of the nasal bone to the inferior margin of the intermaxillary bones	2 6	2 3	2 3	2 7	2 7	3 3
Length of the bony palate	4 1	3 4	2 10	3 1	3 3	4 0
Distance from the anterior margin of the intermaxillary bones to the anterior palatal foramen	1 1	0 10	0 10	1 0	1 3	1 3
Antero-posterior extent of the palatal process of the palate bone	1 1	0 7	0 6	0 7	0 8	||
Breadth of the crown of the first incisor ..	0 6	0 5†	0 5	0 6	0 5	0 7
Breadth of the crown of the second incisor ..	0 4½	0 4†	0 4	0 5	0 3½	0 4
Breadth of the four incisors (upper jaw) ...	1 7	1 6†	1 6	1 6½	1 6	1 9
Length of the grinding surface of all the <i>molars</i> , the <i>bicuspides</i> included.	2 8	2 7	1 9	1 9½	2 1	2 2
Length of the crown of the canine tooth ..	1 4	†	0 6	0 10	1 2	1 0
Breadth of the enameled crown of the canine tooth	0 10	†	0 5⅔	0 7	0 6	0 9
Interspace between the canine and incisor teeth, upper jaw	0 2	0 1½	0 3	0 4	0 3½	0 3
Distance from the anterior margin of the occipital <i>foramen</i> to the posterior margin of the bony palate	3 0	§	2 4½	2 5	2 9	2 10

* To front border of premaxillaries.

† This varies according to the outswelling of the æthmoidal cells: in one female skull of *Trogl. niger* the interorbital space was an inch across.

‡ Of the alveolus.

§ Base mutilated.

|| Suture obliterated.

MISCELLANEOUS.

JOURNEY TO EXPLORE THE PROVINCE OF PARÀ.

MESSRS. Wallace and Bates, two enterprising and deserving young men, left this country last April on an expedition to South America to explore some of the vast and unexamined regions of the province of Parà, said to be so rich and varied in its productions of natural history. They have already forwarded two beautiful parcels of insects of all orders, containing about 7000 specimens in very fine condition, and a vast number of novelties, besides other very rare species, some of which were known only to the entomological world by the beautiful figures in Cramer and Stoll, and a few shells and bird-skins. The last parcel is the result of their journey up the river Tocantins. The following passage is an extract from their letter to Mr. S. Stevens, dated Parà, Oct. 23, to whom the consignments have been forwarded, and who has the disposal of them (see Advertisement on cover).

“If any one is curious about our trip up the Tocantins, you may inform them that we ascended to about the 4th parallel of S. lat. near the Rio Tabocas, having reached Arroya, the last abode of civilized people, and passed a little beyond to view the rapids called Guaribas. We hired one of the heavy iron boats with two sails for the voyage, with a crew of four Indians and a black cook. We had the usual difficulties of travellers in this country in the desertion of our crew, which delayed us six or seven days in going up; the voyage took us three weeks to Guaribas and two weeks returning. We reached a point about twenty miles below Arroya, beyond which a large canoe cannot pass in the dry season, from the rapids, falls and whirlpools which here commence and obstruct the navigation of this magnificent river more or less to its source; here we were obliged to leave our vessel and continue in an open boat, in which we were exposed for two days, amply repaid however by the beauty of the scenery, the river (here a mile wide) being studded with rocky and sandy islets of all sizes, and richly clad with vegetation; the shores high and undulating, covered with a dense but picturesque forest; the waters dark and clear as crystal; and the excitement in shooting fearful rapids, &c. acted as a necessary stimulant under the heat of an equatorial sun, and thermometer 95° in the shade. Our collections were chiefly made lower down the river. During the five weeks of our journey we had no rain till the last two days. The weather here is as delightful as ever; the mornings invariably fine, and a shower in the afternoon every third or fourth day, which cools and refreshes everything delightfully. The heat is never oppressive; the nights always cool; there can certainly be no climate in the world superior to this, and few equal. Since sending our last collection, we have had further experience of the rarity of insects in this country. The Lepidoptera are numerous in species, but not in individuals; the Coleoptera are exceedingly scarce, and other orders are gene-

rally, like the Lepidoptera, sparing in individuals ; we attribute it to the uninterrupted extent of monotonous forest over which animal life is sparingly but widely scattered. However this makes a difference in the commercial value of the subjects. The present collection is the fruits of two months' devoted and almost exclusive attention to insects. Shells and Orchids continue to be exceedingly scarce."

How to prevent the Attacks of the Bed-bug, Cimex lectularius.

By JOHN BLACKWALL, F.L.S.

To Richard Taylor, Esq.

Oakland, December 7th, 1848.

MY DEAR SIR,—A short communication of mine, printed in the 'Annals and Magazine of Natural History,' second series, vol. ii. pp. 357–359, recommending the adoption of a method of preventing the attacks of the bed-bug, founded on the fact, established by observation and experiment, that this loathsome insect, in consequence of not being provided with a climbing apparatus, is incapable of ascending hard dry bodies having highly polished perpendicular surfaces, has elicited, I perceive, a few strictures from the pen of your correspondent Walter White, Esq., to the purport, that the plan proposed is neither new in kind nor efficient in operation ('Annals and Magazine of Natural History,' second series, vol. ii. pp. 457, 458).

To the spirit in which the strictures are made, no objection can possibly be entertained ; but I may be allowed to remark, that the sole object I had in contemplation when obtruding upon the readers of your widely-circulated Journal my thoughts in connexion with this practical application of entomological knowledge to the domestic comfort of thousands of human beings, was public utility ; whether the scheme propounded had novelty to recommend it or not, I had small means of ascertaining, and, indeed, did not stop to inquire, being satisfied that, speaking generally, it was, at all events, either unknown or strangely disregarded.

With reference to the only circumstance advanced by Mr. White as militating against the efficacy of the project I have enunciated ; namely, that bugs are in the habit of crawling up walls and along ceilings until they perceive that they are directly over beds, when they quit their hold of the plaster and drop upon them, I would observe, that although neither reading nor personal experience had made me acquainted with this remarkable instinctive phænomenon in the natural history of the bed-bug, yet the idea had occurred to my mind that such a descent might sometimes happen accidentally ; but that as it would probably be a rare event, and, except in the case of an impregnated female, would not be likely to produce permanent inconvenience, any special provision to counteract it was deemed unnecessary. Considered as the result of an innate propensity this act assumes a widely different character, and it becomes a matter of importance to determine in what manner it can be guarded

against : fortunately the difficulty is not great ; a canopy composed of any light compact material closely attached to a wooden frame in whose outer margins glass cylinders are so far imbedded as to leave a bold, convex, exterior surface, would completely answer the purpose. This canopy, whose area must exceed that of the bed, may be supported on the summits of the bedposts or suspended from the ceiling, as may be most convenient ; and if its periphery were constructed without angles, it would be a decided advantage. When the extreme difficulty of extirpating bugs from rooms, especially in old houses where they have been suffered to multiply to excess, is borne in mind, the desirableness of possessing the means of securing beds from their insidious approaches will scarcely be denied.

The plan of protection against the attacks of the bed-bug which I have proposed or advocated, if the latter term should be thought more appropriate, of course was never intended to apply to animals provided with wings or a spinning apparatus ; to prevent their access to beds, recourse must be had to musquito-curtains, or to some similar contrivance ; but with regard to spiders, as they do not seek to prey upon or even to come in contact with the human species, and as the pain consequent upon the wounds which our more powerful indigenous species are capable of inflicting is very slight and speedily subsides, there is nothing to be apprehended from the Araneidea of Great Britain.

I am, my dear Sir, very truly yours,

JOHN BLACKWALL.

DESCRIPTION OF SARCOPTILUS, A NEW GENUS OF PENNATULIDÆ.

BY J. E. GRAY, ESQ., F.R.S. ETC.

Sir William Jackson Hooker lately sent to the British Museum some bottles containing animals in spirits, some from New Zealand, others from South America, and some without any habitats : amongst the latter there is a fine specimen of a Sea Pen, resembling the true genus *Pennatula* in general form, but differing from it most essentially in the form of the *pinnae* and their substance, and presenting a most interesting new form in the family.

Each of the *pinnae* resemble the frond of *Renilla*, Lam. ; they are placed in two crowded rows, one on each side of the upper part of the axis, and, like that genus, they have the polypes scattered over the upper surface of the *pinnæ*, which, as well as the surface of the stem, do not exhibit any spicula, but are smooth and fleshy.

This genus may be considered as the passage between *Pennatula* and *Renilla*.

SARCOPTILUS.

Coral pen-shaped ; *shaft* thick, fleshy, attenuated towards the tip, smooth, slightly striated longitudinally, and granulose on the surface ; *axis* subquadrangular, rather thick, flexible when moist, formed of concentric coats and longitudinal fibres. *Pinnæ* placed in two crowded rows, one on each side of one of the faces of the upper part

of the shaft, kidney-shaped, crumpled, with the polypes scattered on the edge and upper surfaces, especially near the edge. *Polypes* small, when contracted leaving very small papillæ on the surface.

SARCOPTILUS GRANDIS.

Shaft very thick at the base, longitudinally striated. Pinnæ 25 on each side, the lower one smallest.

Hab. —? Brit. Mus.

Length 8 inches.—*From the Proceedings of the Zool. Soc. for March 14, 1848.*

Remarkable Instances of Instinct, or Intelligence, in Animals.

By Dr. WARWICK.

When he resided at Durham, the seat of the Earl of Stamford and Warrington, he was walking one evening in the park, and came to a pond, where fish intended for the table were temporarily kept. He took particular notice of a fine pike, of about six pounds weight, which, when it observed him, darted hastily away. In so doing, it struck its head against a tenterhook in a post (of which there were several in the pond, placed to prevent poaching), and, as it afterwards appeared, fractured its skull, and turned the optic nerve on one side. The agony evinced by the animal appeared most horrible. It rushed to the bottom, and, boring its head into the mud, whirled itself round with such velocity that it was almost lost to the sight for a short interval. It then plunged about the pond, and at length threw itself completely out of the water on to the bank. He (the doctor) went and examined it, and found that a very small portion of the brain was protruding from the fracture in the skull. He carefully replaced this, and, with a small silver tooth-pick, raised the indented portion of the skull. The fish remained still for a short time, and he then put it again into the pond. It appeared at first a good deal relieved, but in a few minutes it again darted and plunged about until it threw itself out of the water a second time. A second time Dr. Warwick did what he could to relieve it, and again put it into the water. It continued for several times to throw itself out of the pond, and, with the assistance of the keeper, the doctor at length made a kind of pillow for the fish, which was then left in the pond to its fate. Upon making his appearance at the pond on the following morning, the pike came towards him to the edge of the water, and actually laid its head upon his foot. The doctor thought this most extraordinary, but he examined the fish's skull, and found it going on all right. He then walked backwards and forwards along the edge of the pond for some time, and the fish continued to swim up and down, turning whenever he turned; but being blind on the wounded side of its skull, it always appeared agitated when it had that side towards the bank, as it could not then see its benefactor. On the next day he took some young friends down to see the fish, which came to him as usual, and, at length, he actually taught the pike to come to him at his whistle and feed out of his hands. With other persons it continued

as shy as fish usually are. He (Dr. Warwick) thought this a most remarkable instance of gratitude in a fish for a benefit received; and, as it always came at his whistle, it proved also what he had previously, with other naturalists, disbelieved, that fishes are sensible to sound.

Dr. Warwick next related an anecdote illustrative of extraordinary instinct in the elephant "*Chunee*," which was shot some years ago at Exeter Change, London, in consequence of his having gone mad. This animal would pick up a shilling from the ground with its trunk, and place it in the waistcoat pocket of the person who intentionally dropped it. Upon one occasion Dr. Warwick dropped a shilling purposely out of the animal's reach, and waited the result with some curiosity. The elephant appeared to consider for some time, and then raising its proboscis to nearly a horizontal position, blew violently against the opposite wall; the reverberation of the wind was so forcible that it blew the coin over; and the elephant repeated its blowing until it had got the shilling within its reach; it then picked it up as usual, and deposited it in the doctor's waistcoat pocket.

The President, Dr. Booth, also related an anecdote of this same "*Chunee*." When the first symptoms of madness were evinced, and it was thought necessary to poison him, a strong dose of mineral poison was inserted into an orange and given to the elephant. The animal was fond of oranges, and immediately swallowed it; but the dose was not strong enough—it merely made him sick. It was attempted to give a still stronger dose in the same manner, but the animal would not take it, and would never again swallow an orange without first crushing it on the ground, as if to smell its contents.—*Proc. of the Lit. and Phil. Soc. of Liverpool*, Nov. iv. p. 76.

BRACHYCLADIUM.

King's Cliffe, Dec. 14, 1848.

As the generic name *Brachycladium*, 'Ann. of Nat. Hist.' series 2, vol. ii. p. 382, is pre-occupied, I beg to substitute for it *Brachycarphium*.—M. J. B.

PREVENTION OF BUGS.

To the Editors of the Annals of Natural History.

Dec. 18, 1848.

GENTLEMEN,—In the Magazine for the last two months are letters on the prevention of the bed-bug (*Cimex lectularius*).

I have used Sir William Burnett's Disinfecting Fluid, the solution of the chloride of zinc; it was applied by means of a feather to all the joints and crevices in the bedstead and with complete success. The solution entering the wood rendered it an unfit, and probably a poisonous habitation for the *Cimex*.

The prevention of these animals is of more importance than some may at first suppose it to be; in some severe diseases, the disturbance

they give the patient may greatly impede recovery, and I have heard of instances where soldiers in barracks finding sleep impossible in bed have gone out of doors, and sleeping there have been seized with inflammation of the lungs or other diseases, dangerous and sometimes fatal.

Yours, &c.,

THOMAS STRATTON, R.N.

METEOROLOGICAL OBSERVATIONS FOR NOV. 1848.

Chiswick.—November 1. Rain, with fog. 2. Fine: cloudy. 3. Overcast: cloudy and fine. 4. Overcast. 5. Clear and frosty: overcast. 6. Overcast. 7. Clear and cold: sharp frost at night. 8. Frosty: bright sun: clear and frosty. 9, 10. Clear: slight frost at nights. 11. Overcast. 12. Slight rain. 13, 14. Very fine. 15. Clear: severe frost at night. 16. Frosty: clear and fine. 17. Densely clouded: rain: peculiar luminosity in the evening: overcast. 18. Densely clouded. 19. Very fine. 20. Densely clouded: rain: boisterous. 21. Clear and fine: peculiar aurora borealis half-past seven P.M. in N.W. 22. Overcast. 23. Rain. 24. Cloudy: clear and frosty. 25. Frosty: overcast: slight rain. 26. Cloudy. 27. Very fine. 28. Cloudy. 29. Densely overcast: boisterous. 30. Clear: cloudy: partially overcast.

Mean temperature of the month 41°·01

Mean temperature of Nov. 1847 44 ·61

Mean temperature of Nov. for the last twenty years 43 ·00

Average amount of rain in Nov. 2·56 inches.

Boston.—Nov. 1. Foggy. 2. Fine. 3. Rain: rain A.M. and P.M. 4. Fine: rain early A.M. and snow P.M. 5. Fine: rain P.M. 6. Cloudy. 7, 8. Fine. 9. Cloudy: snow A.M. 10—14. Fine. 15. Cloudy. 16. Fine. 17. Cloudy: rain A.M. 18. Cloudy. 19. Fine. 20. Cloudy: rain in evening. 21. Fine. 22. Cloudy: rain A.M. 23. Cloudy. 24. Fine. 25. Fine: rain P.M. 26—28. Fine. 29. Fine: rain P.M. 30. Fine.

Applegarth Manse, Dumfries-shire.—Nov. 1. Dull A.M.: soft rain P.M. 2. Fine generally: flying showers. 3. Rain A.M.: cleared: looking frosty. 4. Frost hard: hills covered with snow. 5. Frost hard: sprinkling of snow. 6. Thaw: showers: stormy. 7. Frost: fine clear day. 8. Frost: clear: snow P.M. 9. Fine winter day: frost: snow inch deep. 10. Frost: clear: snow melting. 11. Frost: dull and cloudy: snow gone. 12. Fine: no frost A.M.: gentle frost P.M. 13. Frost A.M.: a change of weather. 14. Frost A.M.: thaw: frost again. 15. Frost A.M.: thaw P.M. 16. Drops of rain occasionally. 17. Rain during night: aurora very splendid. 18. Heavy rain during night: ditto day. 19. Frost A.M.: thaw P.M. 20. Storm of rain and wind: flood. 21. Bleak and dull all day. 22. Rain greater part of day. 23. Fair A.M.: rain P.M. 24. Frost again. 25, 26. Thaw: rain and high wind. 27. Fair and fine. 28. Wet nearly all day: high wind. 29. Frequent showers. 30. Fair, but cloudy.

Mean temperature of the month 39°·8

Mean temperature of Nov. 1847 47 ·7

Mean temperature of Nov. for the last twenty-five years . 40 ·4

Rain in Nov. 1847 3·79 inches.

Average amount of rain in Nov. for twenty years 3·60 „

Sandwick Manse, Orkney.—Nov. 1. Drops: rain: aurora. 2. Showers: hail-showers. 3. Snow: hail-showers. 4. Snow: clear. 5. Showers. 6. Cloudy: showers. 7. Showers: sleet. 8. Snow-showers: clear: frost. 9. Cloudy: rain. 10. Cloudy: clear: aurora. 11. Bright: drizzle: showers. 12. Fine: clear. 13. Cloudy: showers. 14. Cloudy: hail-showers. 15. Cloudy: showers. 16. Bright: cloudy. 17. Showers: aurora. 18. Damp: showers: aurora. 19. Hoar-frost: showers. 20. Rain. 21. Rain: cloudy: aurora. 22. Rain. 23. Showers: aurora. 24. Cloudy: clear. 25, 26. Cloudy: rain. 27, 28. Showers. 29. Cloudy: showers. 30. Showers.

Days of Month.	Barometer.				Thermometer.				Wind.			Rain.		
	Chiswick.		Dumfries-shire.		Chiswick.		Dumfries-shire.		Chiswick. 1 p.m.	Boston.	Dumfries-shire.	Chiswick.	Boston.	Dumfries-shire.
	Max.	Min.	8½ a.m.	9 a.m.	9 p.m.	8½ a.m.	Max.	Min.						
1848.														
Nov.														
1.	29.602	29.505	29.15	29.48	29.48	29.49	29.50	46½	e.	calm	ws.w.	.03		.05
2.	29.765	29.697	29.10	29.58	29.51	29.63	29.69	41	sw.	ssw.	sw.w.			.30
3.	29.614	29.446	29.16	29.40	29.56	29.76	29.78	36	sw.	sw.	n.	.07		.17
4.	29.737	29.496	29.16	29.60	29.66	29.72	29.72	33	n.	nw.	nw.	.20		
5.	29.808	29.589	29.43	29.48	29.38	29.20	29.33	44	sw.	sw.	nw.	.01	.06	.24
6.	29.645	29.538	29.27	29.38	29.24	29.18	29.14	39	w.	w.	wnw.	.03		.02
7.	29.879	29.518	29.14	29.40	29.70	29.49	29.81	40	nw.	w.	nw.	.04		.39
8.	30.084	29.983	29.12	29.94	29.99	29.97	30.15	33	nw.	nw.	n.		.40	.17
9.	30.319	30.169	29.90	30.24	30.30	30.28	30.20	40	nw.	nw.	n.			
10.	30.357	30.306	30.02	30.28	30.40	30.37	30.41	44	n.	n.	n.	.01	.10	.09
11.	30.334	30.295	30.00	30.39	30.40	30.44	30.45	45	ne.	nw.	nw.	.01		.07
12.	30.419	30.357	30.04	30.46	30.46	30.48	30.45	46	ne.	n.	nnw.	.04		.02
13.	30.429	30.323	30.07	30.38	30.21	30.25	30.17	49	n.	nnw.	nnw.			.01
14.	30.351	30.281	29.88	30.24	30.28	30.25	30.31	37	n.	n.	n.			
15.	30.435	30.421	30.04	30.35	30.20	30.25	30.04	45	n.	n.	w.			.02
16.	30.316	30.235	29.86	30.05	30.03	30.07	29.82	39	w.	w.	w.			.25
17.	30.073	29.808	29.55	29.69	29.50	29.37	29.25	40	sw.	ws.w.	nw.	.04		.50
18.	29.729	29.513	29.20	29.30	29.33	29.18	29.35	38	sw.	sw.	w.	.03	.02	.26
19.	30.050	29.793	29.46	29.71	29.68	29.64	29.38	41	nw.	nnw.	w.			
20.	29.874	29.581	29.34	29.25	29.10	28.77	28.73	46	sw.	s.	sw-w.	.09		1.04
21.	29.662	29.523	29.20	29.23	29.20	29.00	29.43	35	sw.	sw.	w.	.03	.14	.65
22.	29.258	29.168	28.93	29.00	28.87	29.20	28.95	40	sw.	s.	e.	.01	.10	.31
23.	29.207	29.151	28.80	28.95	29.18	28.87	29.18	41½	s.	s.	e.	.04		.32
24.	29.763	29.391	29.33	29.56	29.80	29.46	29.81	39	n.	n.	nnw.			.05
25.	30.084	29.925	29.70	29.78	29.50	29.71	29.38	43	s.	sw.	ese.	.05		
26.	29.869	29.826	29.40	29.48	29.45	29.21	29.06	45	sw.	s.	w.	.38	.14	.18
27.	30.078	29.772	29.38	29.56	29.78	29.47	29.57	46	w.	ssw.	w.			.26
28.	30.090	29.962	29.56	29.60	29.39	29.28	28.90	47	sw.	sw.	sw.			.27
29.	29.919	29.742	29.40	29.54	29.48	29.26	29.40	45	sw.	w.	sw.	.12		.34
30.	29.893	29.713	29.38	29.57	29.57	29.44	29.46	41	sw.	w.	w.	.01	.12	.25
Mean.	29.954	29.800	29.46	29.695	29.687	29.623	29.627	35.1	41.96	41.48		0.90	1.02	2.73
								45.7						6.23

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SECOND SERIES.]

No. 14. FEBRUARY 1849.

X.—*The Musci and Hepaticæ of the Pyrenees.*
By RICHARD SPRUCE*.

[With three Plates.]

BEFORE entering upon an enumeration of the Musci and Hepaticæ of the Pyrenees, it will be proper to indicate the sources from which it has been derived. I have not been able to find any trustworthy record of mosses gathered in the Pyrenees previous to the time of Bridel, who in 1803 visited the Pyrénées Orientales and the northern part of Catalonia, where he discovered his *Bartramia stricta*, *Barbula chloronotos* and some others. Of Bridel's mosses I have seen only a very few, communicated by Professor Arnott from the herbarium of M. Requier. In the 3rd edition of the 'Flore Française' (1815) several Pyrenean stations of mosses are recorded, on the authority of DeCandolle, Ramond, Dufour and Grateloup. The two botanists last-named have since that period continued to pay occasional botanical visits to the Pyrenees, almost up to the present time, and to their liberality I owe specimens of such mosses as they collected. In 1825 the eastern and central Pyrenees were visited by our distinguished countrymen, Messrs. G. Bentham and G. A. Walker-Arnott, and the latter gentleman has kindly communicated to me specimens of nearly all his Pyrenean mosses, a few only of which he has noticed in "A Tour to the South of France and the Pyrenees," inserted in the 'Edinburgh New Philosophical Journal' for April 1826. Still later, from 1828 to 1830, the eastern Pyrenees were at various times partially explored by Dr. C. Montagne, whose knowledge of general Cryptogamy is unrivalled, and his discoveries, including numerous lichens and not a few mosses, were announced by himself in the 'Archives de Botanique,' tom. i. (1833), under the title of "Notice sur les Plantes

* Read before the Botanical Society of Edinburgh, Jan. 11th, 1849.
Ann. & Mag. N. Hist. Ser. 2. Vol. iii.

Cryptogames récemment découvertes en France," &c. Most of these I have had the opportunity of examining. In 1835, Dr. Grateloup began to publish in the 'Actes de la Société Linéenne de Bordeaux,' tom. vii., a "Cryptogamie Tarbellienne, ou Description succincte des Plantes cryptogames qui croissent aux environs de *Dax*, dans le Dépt. des *Landes*," in which were to be comprised all the Cryptogamia growing within 25 leagues of *Dax*, a district which would include the extreme Western *Pyrenees*; but it proceeded no farther than the publication of the *Characæ*, *Filices* and *Hepaticæ*, for specimens of most of which I am under obligation to Dr. Grateloup. About the year 1843, MM. Philippe and de Lugo, two botanists residing at *Bagnères-de-Bigorre*, began to collect the mosses and *Hepaticæ* of the neighbouring mountains, and on the occasion of my visit to that city, two years afterwards, they put into my hands, without reserve, specimens of all they had succeeded in finding. A few mosses have also at different times been gathered in the *Pyrenees* by MM. des Moulins, Durieu, Gaston-Sacaze, and probably by others of whom I have not heard, and of whose labours I cannot therefore make that honourable mention which is their due. In 1845 came my own visit to the *Pyrenees*, undertaken principally (though not solely) for the purpose of studying the *Musci* and *Hepaticæ*, and extending through a period of nearly eleven months. It will not be without use if I here briefly retrace my steps, as some repetition will be thereby avoided, and an opportunity will be afforded of indicating the position of certain localities, the names of which are of frequent recurrence in my catalogue, though too obscure to be found in an ordinary map*.

I arrived at *Pau*, the *chef-lieu* of the Dept. of the *Basses-Pyrénées*, and the ancient capital of *Béarn*, in the early part of May 1845, and my first herborization in the *Pyrenees* was made on the 13th of the same month. My excursions comprised, besides the woods, &c. adjoining the town of *Pau*, the villages of *Jurançon*, *Gélos*, *Rontignon* and *Narcastet*, lying on the southern bank of the *Gave de Pau*, with the valleys running up from them to the southward, among what may be called the skirts of the *Pyrenees*; and the village of *Bilhères*, lying south of the same river. From the 29th to the 31st were devoted to a visit to *Oloron*, at the entrance of the *Vallée d'Aspe*, along which runs one of the most frequented roads into *Spain*. On the 11th of June I again left *Pau* for *St. Sever*, in the *Landes*, on a visit to Dr. *Léon Dufour*, the eminent naturalist, where eight days were usefully spent in exploring the neighbouring *landes*, especially

* For a fuller account of my tour consult the 'London Journal of Botany,' vol. v. p. 134.

those of Mugriet (Commune of Souprosse) a few miles distant from St. Sever, and on the opposite side of the Adour. Returning thence to Pau, I again started on the 25th for Laruns, a little town lying about 26 miles to the southward, near the upper extremity of the Vallée d'Ossau, and midway between the Eaux Bonnes and the Eaux Chaudes. Here commenced my acquaintance with the *real* Pyrenees. My excursions included the Pic de Ger and the Montagne Verte, the former overlooking the Eaux Bonnes from the south and the latter from the north; the Gorge de Hourat, conducting to the Eaux Chaudes, and watered by the Gave de Gabas; the Gave de Valentin, which uniting at Laruns with the Gave de Gabas, forms the Gave d'Ossau; the village of Béost and the hameau of Bagès (celebrated as the residence of Gaston-Sacaze, the shepherd-botanist). Descending the Vallée d'Ossau and again taking Pau in my way, I proceeded on the 8th of July to Argélez, in the Dept. of the *Hautes Pyrénées*. The following day was given to the herborization of Pierrefitte, on the south side of the valley (or rather *plain*) of Argélez, and at the confluence of the gorges of Luz and Cauterets. On the 11th I ascended to Cauterets, where I remained until the end of the month. My excursions from it were to the Pont d'Espagne and Lac de Gaube, ascending the Val de Jéret along the banks of the Gave de Marcadaou; to the valleys of Lutour and Combascou, and to Mont Lizé. On the 2nd of August, accompanied by Dr. Southby, a compatriot enthusiastic in the pursuit of natural history, I crossed the central chain by the Port de Cauterets to the baths of Panticosa in Aragon. In this excursion, which occupied four days, numerous interesting flowers, but scarcely any mosses, were added to my collection. Returning to Cauterets, and descending from thence to Argélez, on the 8th I again ascended to Luz, at the entrance of the valley of Barèges. From Luz I visited the celebrated Chaos and Cirque de Gavarnie, the Vallée d'Estaubé, &c., but my bryological collections were not much swelled thereby. On the 20th I crossed the Tourmalet to Bagnères-de-Bigorre, in the valley of the Adour. My stay was but short, for the present, and my only excursion of importance was to the flowery Mont Lhieris. The 27th and 28th of the same month were taken up in walking through the mountains, by way of the Hourquette d'Aspin, the Vallée d'Aure and the Port de Peyresourde, to Bagnères-de-Luchon, in the Dept. of the *Haute Garonne*. During my stay here of five weeks, I explored the whole of the magnificent Vallée du Lys (lateral to the valley of Luchon) with its four lakes and twenty-four cascades, and I ascended the lofty mountain of Crabioules (mountain of *crabes* or *izards*) which bounds it on the west, as far as the snow-line on the 1st and 2nd of October. Before this time I had visited the

mountain of Superbagnères, which rises from the back of the town, the gorge of Esquierry ("le jardin des Pyrénées"); the Lacs d'Oo (Lac de Séculéjo and Lac d'Espingo) lying between Mont Crabioules and the Vallée d'Aure; the Vallée de Burbe (in which is the Bois de Gouerdère), and, passing through the Port de Portillon at its extremity, the upper part of the Vallée d'Aran in Catalonia; and on the 10th, 11th and 12th of September, passing through the Bois de Sajust and the Port de Bénasque (in the central chain), I had ascended the Maladetta in Aragon. Leaving Bagnères-de-Luchon and the Haute Garonne on the 4th of October, I returned to Bagnères-de-Bigorre, and occupied myself until nearly the end of the month in exploring its environs, by which my collection of pleurocarpous mosses was much enriched. The localities examined were the rocks of Bédât and Salut, close by the town; Mont Lhieris and the woods of Gerde and Asté at its base; the Gorge de Labassère; the Vallée de Lesponne with Lac Léhou (otherwise Lac Bleu), and a tributary valley (Ardalos) extending to the base of the terminal cone of the Pic du Midi. The autumn being unusually prolonged, and the summits still clear of snow, I undertook another expedition to the Basses Pyrénées, and on the 1st of November proceeded again to Laruns, where I remained until fairly driven away by the coming of winter. Besides the localities visited in summer from this station, I now examined the Vallée de Béost, which leads across the Col de Louvie to the Vallée d'Argèlez; the upper part of the Gave de Valentin towards the Col de Tortes; the mountain (Goursi) which shades Laruns on the south; and Gabas, near the base of the Pic du Midi. Driven from the mountains, my next destination was, by way of Pau, to Dax (*Aquæ Augusta Tarbellicæ*) in the Landes (*Ager Syrticus*), where I arrived on the 18th of November. In the midst of almost unceasing rain I visited in this rich district the ophitic rocks of St. Pandelon on the banks of the Luy (a tributary of the Adour), the chalk rocks of Tercis, and the woods of Saubagnac and La Torte. Having devoted a fortnight to a re-examination of the neighbourhood of Pau, I returned early in December to Bagnères to winter. In the Pyrenees, as throughout nearly all the rest of Europe, the winter of 1845-6 was remarkably mild, and by the month of February the lower mountains were quite clear of snow. I availed myself of this circumstance to explore the district almost completely, and in one instance to make, in company with M. Philippe, an excursion of four days (from the 5th to the 8th of February) into the heart of the mountains, for the purpose of examining the back of the Pic de Mont-Aigu and the Vallée de Castelloubon (otherwise V. de Gazos), which is separated by only a narrow ridge from the valleys of Luz and Argèlez. Even at

that season we were able to reach an altitude of 7000 feet, and might easily have gone higher, but the ground at that height, though almost clear of snow, was frozen to the depth of several inches, and the waterfalls were changed into sheets of ice. The chief localities examined near Bagnères, and not previously named, are the forests of Transoubât and of L'Escaladieu (the latter on the road to Toulouse); the valleys of Campan, Serris and Trébons; the Bois de Lagaillaste and the Camp de César, both near the village of Pouzac; the *Côtes schisteux* of Loucrup and the Bois de Montgaillard, on the road to Lourdes. These examinations enabled me to add extensively to the list of mosses previously observed by MM. Philippe and de Lugo. Finally quitting Bagnères early in March, a last visit to Pau rendered my collection of the mosses of the Western Pyrenees still more complete; and in proceeding thence to Paris, two days spent at St. Sever with the excellent Dufour, afforded me rarities unobserved the preceding year.

In this *résumé* of my wanderings I have avoided alluding to the species collected, but it will be seen, by tracing my track on the map, that I executed a network of journeys sufficient to explore pretty fully the tract of mountains traversed, extending from the Vallée d'Aspe on the west to the Vallée d'Aran on the east, and to enable me to state with considerable confidence the amount and distribution of species within these limits.

Since my return from the Pyrenees I have had a few additional species and habitats from my friend Philippe, and also from M. Schimper, who passed through part of the Pyrenees in 1847 on his way into Spain.

It must in conclusion be acknowledged, that it is only botanists resident in the Pyrenees who have it in their power to present to the world a complete flora, whether Phanerogamic or Cryptogamic, of these mountains. Botanical geography is a subject that can be but very imperfectly studied in the cabinet, and in sitting down to arrange the materials collected on a distant expedition, one always finds some deficiency, some essential observation omitted, which, to a person on the spot, might be supplied by travelling possibly only a few paces.

General considerations on the structure, &c. of the Pyrenees.—The Pyrenees may be aptly compared to an immense barrier, raised by nature's hand for the separation of two nations, and extending from sea to sea. The transversal ridges which spring here and there from the central chain may be considered as the buttresses, or as the outworks of this great fortification. The area occupied by these mountains lies between 3° 20' E. and 2° 0' W. long. (from Greenwich), and from a little north of the 43rd parallel nearly to the 42nd. Their direction, from the

Mediterranean to the Bay of Biscay, is nearly W. by N.; and their length, from Cape Creux to the Port des Passages, is about 270 English miles. It is well known that the Pyrenees have at the latter limit reached but half their length, and that their continuation constitutes the elevated ridges of Bizcaya, Asturias and Galicia, up to their real termination at Cape Finisterre; at present, however, we have only to do with that portion which separates France from Spain, and to which the name "Pyrenees" is popularly limited.

When attentively considered, the Pyrenees will be found to consist of *two* chains: the *western*, which increases in altitude from the ocean to the Maladetta (10,722 ft.*), its highest point, whence it rapidly sinks to the opposite sea; the *eastern* commencing north of the Maladetta, with hills of slight elevation, increases in height as it approaches the Mediterranean, not far from which is Mont Canigou (8652 ft.), one of its loftiest summits. From the point of dislocation is thrown off to the northward a remarkable embranchment, which separates the basin of the Garonne from that of the Adour, giving birth to the latter river, and stretches through the Dept. of the Hautes Pyrénées a little way into that of Gers: its highest point is the Pic du Midi de Bigorre (9000 ft.). Some geologists (as M. Reboul) have traced several distinct axes of elevation in the Pyrenees; and M. Elie de Beaumont supposes that they have been upheaved at four distinct epochs, though the great mass owes its elevation to only the third of these, which was posterior to the chalk formation. The fourth epoch of elevation is perceivable only in the localities where serpentine (*ophite*) appears.

The loftiest summits of the Pyrenees are nearly all out of the central chain; the Maladetta, the culminating point of the whole range, is to the southward of it; as is also Mont Perdu, the next in altitude. The depressions (called "Ports" in the medial ridge, and usually "Cols" in the transversal ones) are all of considerable elevation, often from 7000 to 9000 feet, and there are only two passes practicable for carriages, one at each extremity of the chain. On the southern or Spanish side the ascent is more abrupt than on the northern side, where two ridges (at least) parallel to the medial ridge, and yielding to it very little in height, are usually distinctly traceable. The Spanish Pyrenees are also watered by fewer streams, have fewer lakes, and are less clad with forests than the French. On both sides the valleys are in most cases steep; the *basins* we successively encounter in

* The altitudes are all in French measures, and I have given very few, for besides that I had not the opportunity of determining any myself, the altitude of the same mountain, as stated by different observers, often varies considerably.

ascending them are usually small, and occupied either by lakes, or by alluvium deposited by the descending streams. In only two cases have I seen hollows filled with peat, one on Mont Goursi in the Basses Pyrénées, and the other at the head of a small valley, lateral to the Vallée de Lesponne in the Hautes Pyrénées.

The line of perpetual congelation in the Pyrenees, I assume from my own observations to be at an average height of nearly 9000 feet, or more than 1000 feet higher than in the Alps. One authority, now before me, fixes it at 8718 feet, and Ramond estimated it at from 8100 to 8400 feet, which I do not hesitate to say is much too low. It varies however considerably with the degree of exposure and even with the form of a mountain, and the snow is uniformly found to melt less, and consequently to descend lower in an eastern exposure than elsewhere. Hence, even on the highest mountains, the band of perpetual snow is not more than from one to two thousand feet broad.

The streams which take their rise on the *southern* slopes of the Pyrenees flow nearly all into the Ebro. On the *northern* slopes, the space lying opposite the western half of this drainage of the Ebro is occupied by the Adour and its tributaries, while the space corresponding to the eastern half, extending from the source of the Adour to that of the Arriège, is occupied by the upper part of the basin of the Garonne. In the extreme eastern angle, on both the northern and southern side, are various small streams which run directly into the Mediterranean. This drainage of the rivers would seem to afford us the basis of a division of the Pyrenees, for the purpose of estimating the distribution of plants on their surface; but on trial such a division will be found intractable, and I prefer another which separates the plants into more distinct groups, and corresponds very nearly with that adopted by the *botanistes sédentaires* of the Pyrenees. I divide the Pyrenees into *three districts*, the *Western*, the *Central*, and the *Eastern*, the limits of which I proceed to define.

The *Central Pyrenees* are comprised between the upper part of the Gave de Pau, from its source at the Cirque de Gavarnie as far as to the bridge of Lourdes, on the *west*; and Mont Maladetta and the Vallée d'Aran, watered by the infant Garonne, on the *east*; or from the meridian of Greenwich* to about 50 minutes of east longitude. This district includes, in France, the upper part of the Dept. of the Haute Garonne and most of the upper part of the Hautes Pyrénées; in Spain, part of Aragon and a very small angle of Catalonia. It is watered by the upper

* The village of Luz, in the valley of Barèges, is exactly in the longitude of Greenwich.

branches of the Adour and Garonne, and contains the highest mountains and the deepest valleys in the Pyrenees, as well as the most extensive forests. Glaciers of great extent are found in this district only; the principal are those which occupy the northern slopes of the Maladetta and Crabioules.

The *Western Pyrenees* extend from the Central to the ocean at Bayonne and St. Jean de Luz. They include, in France, the Dept. of the Basses Pyrénées and part of the Landes, stretching as far as the Adour at St. Sever and Dax, besides a small portion of the Hautes Pyrénées; in Spain, a small part of Navarre and most of the northern part of Aragon. This district extends farther to the north than either of the others; it is consequently colder at the same altitude, and in the sandy plains bordering on the Adour and the ocean the climate is much more humid.

The *Eastern Pyrenees* are comprised between the Central and the Mediterranean. In France they occupy the whole length of the Depts. of Arriège and Pyrénées Orientales; in Spain, nearly all the northern part of Catalonia. This district is the most southern, the warmest and driest, and the most denuded of forests of the whole three*.

A rough sketch of the mineralogy of the Pyrenees, so far as it is connected with the distribution of plants, will conduce to a more complete idea of the peculiarities of these divisions. The igneous rocks of the Pyrenees do not, as in the Alps, constitute some of the loftiest mountains, and the highest point at which I am aware of the existence of granite is on the summit of the Pic du Midi d'Ossau (9186 ft.), unless it attains the summit of Néouvielle (9696 ft.), as some maintain. In the eastern part of the Western Pyrenees it constitutes the mass of the mountains above Cauterets, especially those which include the valleys of Combascou, Lutour and Jéret, and the Lac de Gaube; from whence it passes (by the Vallée d'Azun, &c.) into the upper part of the Vallée d'Ossau, where I have observed it from below the Eaux Chaudes to the Pic du Midi, and on the circumjacent mountains, in which it is the predominant rock. From the Vallée d'Ossau it dips at once so profoundly as not to be observed in the deepest parts of the Vallée d'Aspe, or in any of the valleys to the westward, until it reappears near Bayonne, in the *massif* of Cambo. In the Central Pyrenees it appears in the valley of Barèges (continued from the valley of Cauterets) and about the base of the Pic du Midi de Bigorre; but, with this latter excep-

* I should add, that great part of the Arriège is still a *terra incognita* to me, and I especially commend its exploration to resident cryptogamists. Probably, from its containing some very lofty summits, as the Pics of Montcalm and Estats, both its character and its vegetable products would require the western part of it to be annexed to our Central district.

tion, it rarely attains the surface in the neighbourhood of Bagnères-de-Bigorre. Near Bagnères-de-Luchon it appears in most of the valleys and at the base of the mountains. From the Central Pyrenees it passes into the Eastern, where, especially in the Dept. of Pyr. Orientales, it constitutes a very large proportion of the surface. In the granite I include gneiss, and possibly some other rocks whose internal structure is of nearly the same character.

Mica-slate (*schiste-micacé*) I have observed in the Western Pyrenees only in the valley of Cauterets, especially at the base of the Monné and on Mont Lizé. Thence it passes into the Central district, where it constitutes the terminal cone of the Pic du Midi, the Pic de Mont-Aigu, and all the adjacent mountains. The wall of rock which supports the waters of Lac Lehou is of mica-schist, and in general the embankments of all the lakes in the Pyrenees are of this rock or of granite. In the Eastern Pyrenees the mountains on the western side of the river Aude are of mica-schist, and I am not aware of its occurrence elsewhere.

Slate (*schiste-argileux*) may be regarded as the most important rock in the Pyrenees, appearing as it does in every part of them. In the W. Pyrenees I have observed it in the Vallée d'Ossau; also near Argélez, where it is the predominant rock, extending from thence along the gorge of Luz to the valley of Barèges, where it meets the mica-schist and other primary rocks. Ascending from Argélez by the valley of Cauterets, it extends (though not uninterruptedly) to the very summit of the central chain. The Port de Cauterets and all the other passes which have fallen under my notice are (as in the Alps) excavated in slate-rock, which is often very siliceous, and cleaves with difficulty in at least two directions. From Cauterets the slate passes into the Central Pyrenees, descending almost to their bases, and attaining the ridge of the central chain, as at the Port de Bénasque, &c. In the Eastern Pyrenees it would seem to occur chiefly about the base of the mountains, skirting the granitic nucleus. The lower mountains in the Pyrenees, whose chief constituent is clay-slate or grauwacke, have commonly rounded summits, and are covered with herbage; but the loftier ones, and especially those of the medial ridge, have a bolder aspect; their sides are furrowed by deep ravines, and their summits are serrated and peaked. When closely examined they are found to be in a state of continual decomposition and degradation, probably from the dissemination of iron pyrites in these rocks.

Transition-limestone (*calcaire de transition*) constitutes also its proportion of the surface of the Pyrenees. In the W. Pyrenees it forms the principal part of the ridge of the central chain, lying to the south of the Pic du Midi d'Ossau. From the val-

ley of Cauterets it would seem to be entirely absent, but it reappears in the Central Pyrenees in the great valley of Barèges, where it extends from the bottom of the valley of Gèdre to a little beyond the lake of Gavarnie, and plunges under the immense mass of alpine limestone of the Marboré. The lower hills near B.-de-Bigorre, especially the Pic de Lhieris, are formed almost entirely of it, and here it often presents itself in thin beds, alternating with clay-slate. In the upper part of the valley of Luchon, and in all the surrounding mountains, I do not recollect to have observed any calcareous rock. In the E. Pyrenees, transition-limestone would seem to occur amongst the granitic formations in detached masses (accompanied however by slate) chiefly in the neighbourhood of Villefranche and Prats de Mollo, and in the Corbières. The ascents of mountains of transition-limestone are interrupted by escarpments, which are rarely of great elevation.

Of secondary rocks, the only one which I shall have occasion to mention is oolitic limestone (*calcaire alpin*). To this rock the Pyrenees owe some of their grandest features, as it forms escarpments in some instances considerably exceeding a thousand feet in altitude, as at the Cirque de Gavarnie, the termination of the Vallée d'Estaubé, &c.; but wherever it attains the alpine region (as in the instances just cited) I have found it quite destitute of mosses, probably from its exposed position, above the region of forests. It is only in the lower hills of the Western Pyrenees, especially near Pau, where it occurs as a conglomerate, that the alpine limestone has afforded me any cryptogamia. Some of Dr. Arnott's mosses from the Pyr. Orientales, judging from the fragments attached to the specimens, have been gathered on alpine limestone.

Trap-rocks I have remarked in the Pyrenees in small detached masses, but I have gathered cryptogamia only on a rapidly decomposing ophite at Labassère near B.-de-Bigorre, and at St. Pandelon near Dax.

This brief sketch of the chief rocks of the Pyrenees is confessedly very imperfect; it is also designedly *superficial*, for it is only by the surface-rock that plants whose roots rarely penetrate to the depth of an inch can possibly be influenced. The position, too, of any rock in the geological series cannot be said to have anything to do with the distribution of plants, though the presence of a certain mineral is in many cases essential to their existence. From my observations in the Pyrenees and elsewhere, I have ascertained pretty accurately what mosses require a matrix containing *carbonate of lime*; these will be specified as they occur. They have obviously no preference for primitive, transition, or secondary limestone, but they are always most abundant and

luxuriant on limestones of which the surface rapidly decomposes ; hence the older limestones, which in the Pyrenees are often transformed into marble, are never in that state prolific in mosses. Of those species which absolutely *refuse* to vegetate on limestone (and they are not very numerous), some are found on a great variety of rocks ; but probably when carefully examined these rocks would be found to contain some one element, essential to all the species making choice of them. *Silex*, for example, seems necessary to certain *Grimmiæ* ; and there are a few mosses rarely found except on rocks containing a large proportion of iron. It is scarcely necessary to mention that many mosses are never found on rocks at all, but by exception, some preferring the bark of living trees (*cortical*) and others decayed trunks or logs (*lignal*).

Distribution of Musci and Hepaticæ in the Pyrenees, according to latitude and longitude.—The distribution of plants on any given portion of the earth's surface requires to be estimated both *horizontally* and *vertically*, and if the surface to be considered extend through several degrees of latitude, the two modes will require to be exhibited both separately and in combination. It is obvious that a comparison of the vegetation of any portion of the earth with that of any other portion, or of the whole, must always be incomplete, until the whole of the earth's surface shall have been examined. Hence the following account of the distribution of Musci and Hepaticæ in the Pyrenees can only be regarded as approximatively correct. I enumerate 390 Musci and 91 Hepaticæ in the Pyrenees. Taking the whole number of Musci known in the world to be 2400 (which is rather over than under the limit), and of Hepaticæ to be 1200, this would show the Pyrenees to possess nearly one-sixth of the entire family of Musci and but one-thirteenth of the Hepaticæ, or twice as great a proportion of the former as of the latter. But this proportion is very nearly what we should arrive at in comparing the Musci and Hepaticæ of Europe with those of the rest of the world, so much more numerous are Hepaticæ in the southern than in the northern hemisphere.

The species which attain absolutely their northern limit in the Pyrenees seem to be only the four following :—

Hypnum aureum.
Bryum platyloma.

Tortula cæspitosa.
Southbya tophacea.

Those which attain their southern limit are apparently much more numerous ; but when the mountains of Spain come to be fully explored, the list will probably be somewhat lessened ; and I ought to acknowledge that, possessing no complete list of the Cryptogamia of Italy, I may have assigned the Pyrenees as the southern limit for a few species which in reality extend farther

south in Italy. So far however as I can ascertain, the following species have their southern limit in the Pyrenees :—

Hypnum umbratum.	Mnium spinulosum.
Pyrenaicum.	medium.
plicatum.	Aulacomnion androgynum.
flagellare.	Physcomitrium acuminatum.
striatulum.	Tortula alpina.
cæspitosum.	latifolia.
crassinervium.	aciphylla.
Vaucheri.	papillosa.
pumilum.	Dicranum fulvum.
campestre.	longifolium.
Starkii.	Sauteri.
Mühlenbeckii.	Arctoa fulvella.
pratense.	Anodus Donnianus.
Haldanianum.	Orthotrichum Bruchii.
heteropterum.	rivulare.
catenulatum.	urnigerum.
Sprucii.	Hedwigia imberbis.
trichophorum.	Grimmia anodon.
planifolium.	curvula.
Isoetecium rufescens.	sulcata.
chryseum.	atrata.
Leskea rostrata.	Encalypta commutata.
longifolia.	rhabdocarpa.
Anacamptodon splachnoides.	Polytrichum sexangulare.
Mielichhoferia nitida.	Fissidens grandifrons.
Catocopium nigrum.	Sarcoscyphus adustus.
Bartramia marchica.	Alicularia compressa.
Bryum acuminatum.	Jungermannia sphærocarpa.
polymorphum.	Genthiana.
Zierii.	cordifolia.
concinatum.	Lyoni.
Ludwigii.	Francisci.
obconicum.	Lejeunia ovata.
julaceum.	Frullania fragilifolia.
Mnium spinosum.	Dumortiera irrigua.

Few species can be expected to attain their eastern limit in the Pyrenees (lying as they do on the *western* side of Europe), and I can find only these six, of which all but one (*Fissidens grandifrons*) had been previously supposed to be confined to our own islands :—

Hypnum cæspitosum.	Lejeunia ovata.
Tortula papillosa.	Frullania fragilifolia.
Fissidens grandifrons.	Dumortiera irrigua.

The number of Musci and Hepaticæ which are not found anywhere to the westward of Europe, either on the continent of America or in the intermediate islands, is considerable, and they mostly attain their western limit in the British Isles. Some species which reach their western *European* limit in the Pyrenees (not being found in the British Isles) reappear in N. America, under nearly the same latitude: such are *Hypnum Haldanianum*,

Leskea rostrata and *attenuata*, *Physcomitrium acuminatum*, *Tortula cæspitosa*, *Dicranum fulvum*, *Fissidens grandifrons*, &c. *Tortula chloronotos* reappears in the isle of Teneriffe. There are only the following species whose occurrence westward of the Pyrenees has not yet been recorded :—

Hypnum Pyrenaicum.
Vaucheri.
Isoetecium Philippianum.
Bryum polymorphum.
Mnium medium.

Tortula inclinata.
Encalypta ligulata.
Buxbaumia indusiata.
Plagiochila Pyrenaica.
Scapania apiculata.

Of the few mosses which grow on the southern slope of the Pyrenees, only one species (*Tortula cæspitosa*) was not found at all on the northern. The Spanish Pyrenees have in fact a peculiarly arid aspect (to the eye of a cryptogamist), and correspond well with the distant view I have had of the dry and naked sierras of Spain*.

If we now compare the three districts of the Pyrenees, above defined, one with another, we find a considerable number of species peculiar to each. The following mosses, gathered in the *Western Pyrenees*, were none of them observed in the Central and Eastern Pyrenees. [Those species marked with a (†) are peculiar to the sandy plains of the Landes.]

Hypnum strigosum.
megapolitanum †.
cæspitosum †.
trichophorum.
Catoscopium nigratum.
Bryum Tozeri.
cæspiticium.
erythrocarpon.
torquescens.
platyloma.
Muelleri †.
Mnium spinosum.
Funaria corvexa †.
Entosthodon Templetoni †.

Physcomitrium ericetorum.
acuminatum.
Tortula ambigua †.
papillosa.
latifolia.
cæspitosa.
Trichostomum luridum.
subulatum †.
Dicranum spurium.
Weisia cirrhata †.
Wimmeriana.
Gymnostomum calcareum.
Ptychomitrium pusillum.
Orthotrichum crispulum.

* Cavanilles, in his 'Observaciones sobre la Historia Natural, &c. del Reyno de Valencia (Madrid, 1795),' amongst all the localities which he so minutely describes, mentions but one of bryological promise, where he observed the *solitary moss* which enters into his catalogue of the plants. In speaking of the mountains of Valldigna (p. 218) he says, "Los montes por donde están expuestos al mediodia son secos, y que no hay fuentes en sus raíces : al contrario las faldas septentrionales de todos ellos están sembradas de sitios húmedos y frondosos, y en las raíces nacen fuentes abundantes. . . . En el valle de Barig son innumerables las fuentes que nacen desde Aldaya hasta Puigmola. . . . En estos sitios húmedos y sombríos está siempre viva la naturaleza, cubierto el suelo de vegetales, y casi siembre de flores : allí se disputan las plantas el terreno. La doradilla (*Ceterach*), el polipodio comun, el pteris (*Pt. aquilina*) y la jungermania allanada (*Jg. complanata*) ocupan las hendeduras de las peñas."

Orthotrichum patens.
urnigerum.
Conomitrium Julianum †.
Buxbaumia aphylla †.
Sphagnum cuspidatum †.
compactum †.
Alicularia compressa.

Southbya tophacea.
Jungermannia curvula.
minuta.
dentata †.
Lejeunia ovata.
calcareæ.
Frullania fragilifolia.

The whole of the following were observed only in the *Central Pyrenees* :—

Hypnum Pyrenaicum.
flagellare.
aureum.
falcatum.
Haldanianum.
heteropterum.
planifolium.
depressum.
Neckera pumila.
Entodon cladorrhizans.
insidiosus.
Isoetecium Philippiianum.
striatum.
Leskea rostrata.
longifolia.
Hookeria lucens.
Anacamptodon splachnoides.
Bartramia marchica.
Bryum pyriforme.
longicollum.
Ludwigii.
julaceum.
concinatum.
cirrhatum.
Mnium lycopodioides.
medium.
Dissodon Frœlichianus.
Anacalypta latifolia.
Tortula vinealis.
Ceratodon cylindricus.
Distichium inclinatum.

Dicranum fulvum.
majus.
falcatum.
Arctoa fulvella.
Campylostelium saxicola.
Brachyodus trichodes.
Anodus Donnianus.
Seligeria recurvata.
Anœtangium compactum.
Zygodon conoideus.
Orthotrichum rivulare.
Grimmia anodon.
funalis.
sulcata.
Fissidens osmundioides.
Tetradontium Brownianum.
Sphagnum acutifolium.
squarrosus.
Sarcoscyphus adustus.
Jungermannia Schraderi.
Genthiana.
pumila.
cordifolia.
divaricata.
conuivens.
Lophocolea minor.
heterophylla.
Harpanthus scutatus.
Chiloscyphus polyanthos.
pallens.
Dumortiera irrigua.

The following species are peculiar to the *Eastern Pyrenees*, and when the Hepaticæ of that district come to be ascertained, the list will undoubtedly be extended :—

Hypnum fluitans.
recognitum.
Fabronia pusilla.
Bartramia stricta.
Bryum bimum.
Tortula mucronifolia.
alpina.

Tortula subulata, var. inermis.
gracilis.
Orthotrichum Sturmii.
Grimmia plagiopoda.
trichophylla.
Polytrichum sexangulare.

In glancing over the above lists, we cannot fail to be struck with the great number of species, especially of pleurocarpous mosses, peculiar to the central district. The obvious and true

explanation of this is to be found in what is above remarked respecting the depth of the valleys and the extent and density of the forests; pleurocarpous mosses demanding in the latitude of the Pyrenees a great deal of shade.

A few species, occurring in both the Central and Eastern Pyrenees, were not observed in the Western. They are:—

Hypnum reflexum.	Desmatodon nervosus.
Mielichhoferia nitida.	Dicranum longifolium.
Bryum polymorphum var. curvisetum.	virens.
Timmia megapolitana.	Grimmia atrata.
Trichostomum tophaceum.	Cinclidotus aquaticus.

The list of species wanting to the Eastern Pyrenees, but observed in both the Western and Central, is so very large that I forbear to insert it, feeling assured that when the former district comes to be explored as the two latter have been, it will be found much less deficient than this list would show it. Three mosses, *Amblyodon dealbatus*, *Tortula marginata* and *cuneifolia*, growing in both the Eastern and Western Pyrenees, have not hitherto been observed in the intermediate district.

Were I now asked to name a moss characteristic of the whole Pyrenees, I should say at once *Fissidens grandifrons*, Brid. (the *Dicranum palmiforme* of Ramond), which is a conspicuous ornament wherever moist calcareous rocks are found, but is scarcely met with out of the Pyrenees*. Amongst the Hepaticæ, *Jungermannia acuta* is scarcely less abundant, growing on the same sort of rock. The following species may also be considered respectively characteristic of our three districts, viz. *Southbya tophacea* of the Western, *Isothecium Philippianum* of the Central, and *Bartramia stricta* of the Eastern.

Distribution of Musci and Hepaticæ in the Pyrenees, according to altitude.—We come next to treat of the vertical distribution of plants, the most interesting branch of *Phytostatics*. In attempting to define our zones of altitude by natural boundaries,

* It will not be out of place to mention here a curious circumstance relating to this moss. Its *fruit* has never yet been found, and even its *flowers* were unknown when it was figured in the 'Bryologia Europæa.' A few years ago, Mr. Sullivant discovered female plants at the Falls of Niagara, and in 1846 he published the specimens in his beautiful 'Musci Alleghanienses' (no. 186). In Jan. 1846, a single tuft of male plants was found by myself and M. Philippe on a dripping limestone rock near Bagnères, and the inflorescence will be described in the proper place. These are all the flowers that have ever been found, and it will be a remarkable circumstance if it be ascertained (as this would seem to show) that *only the male plant exists in Europe, and only the female in America!* The obvious conclusion would be that the plant never had fruited, and without artificial aid never would fruit. It has, however, ample means of maintaining and spreading itself without the aid of seeds.

that is, by certain plants which constitute a marked feature in them, it would seem at first sight a great advantage could we select in every country the same species for this purpose; but a little research will suffice to show us the impracticability of this. To go no farther than the Alps; near as they are to the Pyrenees, and similar as their vegetation is in many respects, there are yet important differences. While, for instance, there is no tree in the Alps above the region of the spruce-fir (*Pinus Abies*, L.), in the Pyrenees there is above this a broad and well-marked belt of Scotch fir (*Pinus sylvestris*, L.). Again, there is in the Alps, above the limit to which the oak ascends, a zone in which the birch (*Betula alba*, L.) is the predominant tree; but in the Pyrenees the birch is excessively rare; indeed I do not at this moment recollect having anywhere seen it where I could be certain it had not been planted, and I perceive Mr. Bentham includes it in his catalogue with a mark of doubt. It would also be quite impossible to define any of our climatal zones in the Pyrenees by the distribution of the *heaths*, as has been done for the British Isles by Mr. Watson in his 'Cybele Britannica.' The only "heath-clad hills" I have seen in the Pyrenees, reminding me of our English and Scottish hills, are some of the lower mountains around Bagnères-de-Bigorre, and here the prevailing species is *Erica vagans*, though *Calluna vulgaris* occurs also, sparingly. The latter species seems never to penetrate far into the mountains. Again, *Erica tetralix* is not found at all in the Central or Eastern Pyrenees, but only in the Western. The only heath I have remarked near Bagnères-de-Luchon is *Erica cinerea*. *E. arborea* is abundant in the valley of Argélez and its tributary valleys (Castelloubon, &c.), but is absent from the Central Pyrenees, while it reappears in several parts of the Eastern. It has been shown by M. des Moulins ("Etat de la Végétation sur le Pic du Midi de Bigorre, &c.;" 'Recueil des Actes de l'Académie Royale de Bordeaux,' 1844), that several species of *thistles* occupy zones of altitude in the Pyrenees which are easily ascertained, and he has actually constructed a scale of the distribution of fourteen species in the Pyrénées Centrales, showing the altitudes at which they appear and disappear. But were this scale taken as the basis of a climatal arrangement (which M. des Moulins by no means proposes), how would it assist us in comparing the flora of the Pyrenees with that of Lapland, where according to Wahlenberg, "*Cardui in sylvis admodum rari, omnesque fere inermes sunt. De cætero quoque plantæ vel frutices aculeati in Lapponia non crescunt, &c.*"?

In comparing two distant portions of the earth's surface with each other, in both of which the same plant is extensively distributed, we are not hence to conclude that the zone which it oc-

cupies has in both countries the same *average annual temperature*. Were this the case, such discrepancies as the following would be inexplicable. On Mount Etna, the beech, the birch and the Scotch fir are said to occupy the same zone. In the Pyrenees the beech ceases before the Scotch fir begins, and in the Alps the birch is said to fail even below the spruce-fir. But in Lapland the birch extends far above the Scotch fir, and in fact ascends higher on the mountains than any other tree. Assuming the correctness of these observations (which for Lapland and the Alps cannot be questioned), we are bound to conclude that there are peculiarities of constitution in certain species which enable them to ascend proportionally higher in one latitude than in another*. In other words, an *alpine* flora is not necessarily an *arctic* flora, in its character. Hence the saying of Linnæus, "*Plantæ diversæ indicant altitudinem perpendicularem terræ*," must be regarded not as an *axiom* but as a *problem*, the complete solution of which still remains to be effected.

It will readily be admitted that all our artificial arrangements,

* The discussion of this *idiosyncrasy* would demand an entire volume, but Wahlenberg's explanation of it (Flora Lapponica, Introd.) is worth quoting, and should be borne in mind in comparing the flora of the Pyrenees or of the Alps with that of Lapland. "*Valde probabile mihi videtur a calore meridiano vegetationis gradum præcipue pendere*" (p. xlix, l. c.)—"Temperies tantum illa æstivalis in vegetatione producenda efficax, constituit clima, ejusque gradus determinat." (p. lii.)—"Aliæ plantæ longam magis, quam calidam æstatem sibi exposcunt: ubi temperatura æstivalis media per tres menses gradum 8°·5 (Centigr.) haud attingit, ibi hordeum haud ad maturitatem pervenire potest. Hoc quidem jamdudum infra Enontekis contingit; sed nihilominus tamen arbores variæ æstate brevi et calida hujus regionis contentæ sunt: Betulæ enim et Salices alpes versus longe altius læte propagantur. Arbores coniferæ fere ac Hordeum æstatem longiorem quamquam temperatiorem, requirunt, itaque longe altius ascendunt in alpinis Helveticis quam Betula, &c. Ex observationibus thermometricis allatis constat, æstatem in alpinis Helveticis, etiamsi temperatior sit, fere longiorem esse, quam in alpinis Lapponicis; et pro certo scimus, temperaturam mediam omnium mensium per totum annum eo magis æquabilem esse in montibus Andium Americæ meridionalis, et igitur omnes arbores, calidiorem quam longiorem æstatem requirentes, ibi crescere desinunt duplo longius infra limitem nivalem quam apud nos; sed Hordeum aliaque Cerealia temperie moderata 7 vel 8 graduum contenta, si ea modo longior sit, duplo altius versus limitem nivalem ibi adscendunt quam omnes arbores." (p. liii.)

It is also well known that some plants will bear *forcing*, that is, will survive and flourish under constant excitement and irritation, much better than others; hence we could hardly expect any plant which will not bear some degree of forcing, to thrive in the rapid summer, with its long days and proportionally great meridional heat, of countries bordering on the Arctic circle; should it even subsist through the rigorous winter of that region.

I am sensible how much the absence of exact thermometrical observations takes away from the completeness of this sketch of part of the flora of the Pyrenees. I have none of my own to adduce, except a few made at the foot of the Western Pyrenees in the month of June, when I found the meridional temperature to often exceed 90° Fahrenheit.

whether phytostatical or phytological, are imperfect; yet they have all their use in placing the same object before us under different points of view. As regards the *Pyrenees*, I have judged it best under all the circumstances to adopt the climatal arrangement sanctioned by the usage of the most eminent resident botanists. The first exposition of this is to be found in the writings of Ramond, one of the earliest observers in geographical botany. He ascertained that the oak (*Quercus robur*) ascended from the plains to the height of 1600 metres; that the beech (*Fagus sylvatica*) occupied a zone of from 600 to 1800 metres; the fir (*Pinus Abies*) and the yew (*Taxus communis*) a zone of from 1400 to 2000 metres; and that the Scotch fir (*Pinus sylvestris*) commencing at the latter limit, ascended in its smaller forms (especially that called *Pinus Mughus* by Jacquin) as high as 2400 metres. Above this limit (he observes) there are no more trees. Here commence *shrubs, with dry leaves, and mostly procumbent or prostrate stems*, which are concealed under the snow during the winter. Such are *Rhododendron ferrugineum*, various species of *Daphne*, *Passerina* and *Globularia*, *Salix herbacea* and *reticulata*, &c. Leaving these, we meet humble herbs with *perennial roots, leaves in rosettes* and mostly *naked stems*: first in the series are *Gentiana campestris*, *Primula villosa*, *Saxifraga longifolia*, *Aizoon*, &c.; next, *Ranunculus alpestris*, *nivalis* and *parnassifolius*, *Androsace alpina*, &c.; lastly, *Ranunculus glacialis*, *Saxifraga cæspitosa*, *oppositifolia*, *androsacea* and *grænländica* (Lapeyr., non L.): these, with lichens, reach 3000 or even 3400 metres, and extend to and even beyond the line of eternal snow. Guided by these observations of Ramond, and by others of his own, M. des Moulins, in the admirable memoir above-cited, has proposed to divide the *Pyrenees* into zones of altitude, as follows. The commencement of the *subalpine zone* he places at 4200 feet, about which altitude the cultivation of esculent vegetables (rye, potatoes, cabbages, &c.) ceases. It extends as far as 6000 feet, which is the upper limit of the growth of the spruce-fir and the beech*. The plants of the mountains, united with certain plants frequent in the plains, form the basis of its vegetation, and the real *subalpines* attain in it their greatest development both as to size and number. *Meadows* are scarce in this zone and do not occur above it.

The alpine region M. des Moulins divides into *three zones*. First, the *inferalpine*, which extends from 6000 to 7200 feet, and is characterized chiefly by the presence of *Pinus sylvestris*, which

* My own observations are here somewhat at variance with those of M. des Moulins. The beech has seemed to me to fail ordinarily some hundred feet below the fir, and in effect about the point where the latter attains its greatest development.

even in its most stunted form scarcely passes the upper limit. *Rhododendron ferrugineum* expires in this zone at from 6600 to 6900 feet, and above this altitude the herbage is composed chiefly of *Nardus stricta* (a grass common in the marshes of the Landes !) and of *Festuca eskia*, Ram. (*F. varia* γ. *crassifolia*, Koch ; *Eskio*, *Jispet* and *Oursagno* of the mountaineers of the Pyrenees). Amongst the shrubs characteristic of this zone may be mentioned *Vaccinium Myrtillus* and *uliginosum*, *Empetrum nigrum*, *Sorbus chamaespilus* and *Salix Pyrenaica* ; amongst the herbaceous plants, *Silene ciliata* and *Arenaria ciliata*. *Crocus multifidus*, which is a conspicuous ornament of the lower mountains (as around Bagnères-de-Bigorre), reaches the very summit of the inferalpine zone.

The *medialpine* zone extends from 7200 to 8400 feet. *Festuca eskia* attains the upper limit of this zone, but *Nardus stricta* fails below it. *Juniperus nana* is the giant of the vegetation, already so much contracted. Here the *weeds* which follow the traces of man and of the domesticated animals from the plains, cease to exist. The following species are abundant in this zone : *Statice alpina*, *Gentiana alpina*, *Potentilla nivalis*, *Cherleria sedoides*, *Silene acaulis*, *Iberis spathulata*, Berger., and *Pyrethrum alpinum*.

Lastly, above 8400 feet, in order to characterise the *superalpine* zone, we have merely to add to the plants of the middle zone a very small number of herbaceous plants, *all perennial*, and rarely descending into the medialpine zone. Such are *Ranunculus glacialis* and *parnassifolius*, *Stellaria cerastoides*, *Androsace alpina*, *Sibbaldia procumbens*, *Saxifraga grænlantica*, Lap., and *S. androsacea*.

Thus far M. des Moulins. Of the zone below the subalpine, which I call the *Zona montosa*, he says nothing, because it was not necessary to his estimation of the flora of the Pic du Midi. It corresponds very nearly to Mr. Watson's "Agrarian Region," and were it our sole object to determine the distribution of Phanerogamia within its limits, it would be expedient to divide it into *three* zones, as M. des Moulins does the alpine region. Ascending from the plain, these zones might conveniently be separated, first by the upper limit of the cultivation of the *vine*, and secondly by that of *maize*, and the three divisions would be of nearly equal breadth. The cultivation of the vine in the Pyrenees is, as Humboldt observed it to be in South America, very nearly coterminous with the natural forests of chestnut-trees. It is true that chestnuts occur above the vineyards, but it is only sporadically ; and so do vines occur here and there, trained to cottages in sheltered situations, considerably beyond the zone where they normally find a suitable climate. The cultivation of maize extends to about the point where the box

begins to flourish luxuriantly. For the purpose, however, of estimating the climatal distribution of mosses, it will rarely be requisite to divide the montose zone; and where I find occasion to speak of an *inferior* and a *superior montose zone*, it is to be supposed divided into two equal portions.

In order to enable any one to compare more completely the distribution of plants in the Pyrenees with that of the rest of Europe, and especially with that of our own islands, I add the names of several plants which I have myself observed in the various zones, of which many of them have appeared to me characteristic.

Planities (= Z_0). *Teesdalia nudicaulis*, *Helianthemum alysoides* et *guttatum*, *Viola lactea*, *Silene bicolor*, *Lupinus angustifolius*, *Corrigiola littoralis*, *Illecebrum verticillatum*, *Hyoseris minima*, *Erica scoparia* et *ciliaris*, *Anagallis tenella* et *crassifolia*, *Pinguicula lusitanica*, *Phalangium bicolor*, *Avena Thorei*, *Agrostis setacea* et *elegans*, *Airopsis globosa*, *Cynosurus echinatus*, &c. &c.

Zona montosa (= Z_1). *Pars inferior*. *Ranunculus nemorosus*, *Anemone ranunculoides*, *Hepatica triloba*, *Geranium phæum*, *Saxifraga Geum*, *Asperula cynanchica*, *Prunella grandiflora*, *Stachys alpina*, *Euphorbia hyberna* et *dulcis*, *Cephalanthera ensifolia*, *Kœleria cristata*, *Melica ciliata*.

Zona montosa superior. *Potentilla micrantha*, *Orobis luteus*, *Saxifraga Geum*, *Astrantia major*, *Heracleum Pyrenaicum*, *Arnica montana*, *Cirsium Monspessulanum*, *Prenanthes purpurea*, *Soyeria lapsanoides*, *Scrophularia Scopolii*, *Erinus alpinus*, *Teucrium Pyrenaicum*, *Calamintha sylvatica*, *Rumex scutatus*, *Buxus sempervirens*, *Carex montana*, *Asplenium septentrionale*.

Zona subalpina (= Z_2). *Ranunculus aconitifolius*, *Spiræa Aruncus*, *Meconopsis Cambrica*, *Arabis alpina*, *Hutchinsia alpina*, *Cardamine latifolia* et *resedifolia*, *Viola cornuta*, *Dianthus Monspessulanus*, *Saponaria ocymoides*, *Geranium cinereum*, *Hippocrepis comosa*, *Trifolium alpinum*, *Sempervivum montanum*, *Saxifraga Geum* et *aquatica*, *Chærophyllum hirsutum*, *Sambucus racemosa*, *Galium vernum*, *Ramondia Pyrenaica*, *Scrophularia Scopolii*, *Digitalis purpurea* et *lutea*, *Linaria alpina*, *Veronica Ponnæ* et *saxatilis*, *Tozzia alpina*, *Teucrium Chamædryas*, *Nigritella angustifolia*, *Lilium Pyrenaicum*, *Merendera Bulbocodium*, *Carex ornithopoda*, *Asplenium Halleri*.

Zona inferalpina (= Z_3). *Ranunculus Gouani*, *Helianthemum Œlandicum*, *Viola biflora*, *Gypsophila repens*, *Geranium cinereum*, *Trifolium alpinum*, *Dryas octopetala*, *Geum Pyrenaicum*, *Potentilla alchemilloides* et *rupestris*, *Epilobium alpinum*, *Paronychia serpyllifolia*, *Saxifraga Aizoon* β . *minor*, *Eryngium Bourgati*, *Aster alpinus*, *Homogyne alpina*, *Carduus carlinoides*, *Crepis pygmæa*, *Jasione perennis*, *Erinus alpinus* var. *hirsutus*,

Veronica aphylla, *Bartsia alpina*, *Pedicularis comosa*, *Horminum Pyrenaicum*, *Pinguicula grandiflora*, *Androsace carnea et villosa*, *Primula integrifolia*, *Globularia nudicaulis et rupestris*, *Statice alpina*, *Salix Pyrenaica et reticulata*, *Luzula pediformis*, *Carex sempervirens*, *Festuca varia*, *Aspidium Lonchitis*, *Lycopodium Selago*, *Polypodium Phegopteris*.

Zona medialis alpina ($= Z_4$). *Ranunculus alpestris*, *montanus*, *Pyrenæus*, *Cardamine bellidifolia*, *Draba aizoides*, *Sisymbrium pinnatifidum*, *Saponaria cæspitosa*, *Arenaria purpurascens*, *Stellaria cerastoides*, *Cerastium alpinum*, *Cherleria sedoides*, *Geum montanum*, *Potentilla nivalis*, *Rhodiola rosea*, *Saxifraga aretioides*, *bryoides et muscoides*, *Asperula hirta*, *Aronicum scorpioides*, *Chrysanthemum alpinum*, *Erigeron alpinus*, *Gnaphalium leontopodium et supinum*, *Senecio Tournefortii*, *Crepis pygmæa*, *Taraxacum officinale var. alpinum*, *Campanula pusilla*, *Jasione perennis*, *Phyteuma hemisphæricum*, *Euphrasia minima*, *Pedicularis Pyrenaica et rostrata*, *Pinguicula alpina*, *Soldanella alpina*, *Daphne Cneorum*, *Veronica alpina*, *Juniperus nana*, *Juncus trifidus*, *Luzula spadicæ et pediformis*, *Carex Pyrenaica*, *Festuca varia*.

Zona superalpina ($= Z_5$). *Cardamine bellidifolia*, *Draba nivalis*, *Potentilla nivalis et Salisburgensis*, *Saxifraga bryoides*, *granulata var.*, *muscoides et groenlandica*, *Lap.*, *Senecio Tournefortii*, *Gentiana alpina*, *Myosotis sylvatica var. alpestris*, *Pedicularis rostrata*, *Soldanella alpina*, *Statice alpina*, *Salix retusa et herbacea*, *Luzula spicata*, *Carex curvula et nigra*, *Agrostis vulgaris var. alpina*, *Sesleria disticha*.

Throughout the following catalogue of the mosses, the zones which each species occupies will be distinctly specified; and to enable me to do this in the smallest possible compass, I propose the notation of *zones* above indicated, that is to say, Z_1 for the first zone above the plain, Z_2 for the second, &c., and Z_0 for the plain itself. It is in many cases difficult to ascertain the zone in which a moss has normally its station, for in mountainous countries the seeds, &c. of mosses are carried down by the streams, precisely as those of flowering-plants are; but a large proportion of mosses are found *only* near streams, and that especially in a low latitude, where the requisite degree of moisture is more rarely met with. Hence certain mosses, natives of the alpine region, are occasionally found some thousands of feet below it. To take an instance in *Grimmia spiralis*, a species which is stated by the authors of the 'Bryologia Europæa' to have its "véritable habitat au-dessus de toute végétation forestière." Near Caunterets, opposite the baths of La Raillère, on the rude blocks of granite which are thickly strewn along the banks of the Gave de Marca-daou, this species forms large lax tufts, disfigured by the sand of

the stream, yet bearing a few capsules. This is far *below the commencement of the subalpine zone*; but in continuing to ascend the stream, until we emerge on the broken plain adjacent to the Lac de Gaube, where the only trees are a few scattered pines (i. e. *towards the upper limit of the inferalpine zone*), we find the same species, forming small compact tufts and bearing a profusion of fruit, growing on the same sort of rock, and often far removed from any stream. *Here it is obviously at home.*

The localities visited within Z_5 are for the most part entirely destitute of mosses, in consequence of the declivities being covered with *sliding* fragments of schistose rock. Two species of Hepaticæ, *Sarcoscyphus emarginatus* and *Alicularia scalaris*, common in the plains, ascend in varying forms nearly to the limit of perpetual snow, and with *Jungermannia julacea* form the sole representatives of the tribe in Z_5 . I must also observe, that nowhere in the Pyrenees do mosses and lichens ascend higher than *all* flowering-plants. Even above the line of perpetual congelation, wherever a rock peeps out of the snow (its sides being too steep for the snow to rest upon them), Saxifrages, and two or three other kinds of plants equally hardy, fix themselves in its crevices. This is also the case with lichens, but scarcely with *real frondose mosses*, and I very much doubt whether there be any region in the world (alpine or arctic) where mosses leave below them *every* phanerogamous plant, although we have long been taught to believe that such is the case. Ramond found flowers to accompany Mont Perdu almost to its summit.

I proceed now to exhibit in a tabular form a list of those Musci, Hepaticæ and Lichenes which have appeared to me characteristic of the various zones in the Pyrenees. I have considered a species characteristic of a particular zone for the following reasons: 1. It is either abundantly distributed in that zone throughout the chain, and scarcely seen above or below it; or, 2. It occurs at various (it may be distant) points of the chain, and nowhere abundantly, yet is always confined to one zone; or else, 3. It is distributed through several zones, but exists in its perfect state only in one. A few species flourish with equal luxuriance in two or more zones. Those mentioned for the superalpine zone were almost its sole occupants, and most of them were sterile. The species united by *brackets* were frequently grouped together *in one tuft*, so as to be taken up at once by the hand; or, in the case of crustaceous lichens, occupied the surface of *one stone*. The species printed in *italics* are considered peculiarly characteristic of the zone in which they are placed.

<i>Limes nivalis.</i>	MUSCI.	HEPATICÆ.	LICHENES.
<i>Zona superalpina.</i> (=Z ₅). 8400'.	<i>Polytrichum juniperinum.</i> sexangulare. { <i>Encalypta rhabdocarpa.</i> <i>Hypnum molluscum</i> var. <i>Desmatodon latifolius</i> , var. <i>muticus.</i> <i>Weisia crispula</i> var.	{ <i>Jungermannia julacea.</i> <i>Sarcoscyphus emarginatus.</i> <i>Alicularia scalaris.</i>	<i>Parmelia chryssoleuca.</i> <i>Lecidea atrobrunnea.</i> <i>Umbilicaria proboscidea</i> var. <i>Endocarpon miniatum</i> , var. <i>complicatum.</i>
<i>Zona mediana.</i> (=Z ₄). 7200'.	{ <i>Weisia crispula</i> var. <i>Dicranum Starkii.</i> <i>Arctoa fulvella.</i> <i>Grimmia sulcata.</i> <i>atrata.</i> <i>Tortula vinealis</i> , var. <i>nivalis</i> <i>Dissodon Frœlichianus.</i> <i>Anacalypta latifolia.</i> <i>Bryum turbinatum</i> , var. <i>latifolium.</i> <i>Hypnum plicatum.</i>	{ <i>Jungermannia julacea.</i> <i>Sarcoscyphus emarginatus.</i> <i>Alicularia scalaris.</i> <i>Gymnomitrium concinnatum.</i>	{ <i>Umbilicaria proboscidea.</i> <i>atropruinosa.</i> <i>Cetraria pinastri.</i> { <i>Cladonia vermicularis.</i> <i>gracilis.</i> <i>Lecidea Morio.</i> <i>confluens.</i> <i>Wahlenbergii.</i> <i>Parmelia ventosa.</i> <i>Peltigera crocea.</i>
<i>Zona inferalpina.</i> (=Z ₃). 6000'.	{ <i>Hypnum plicatum.</i> <i>Leskea incurvata.</i> <i>Tortula aciphylla.</i> <i>Dicranum Starkii.</i> <i>Desmatodon latifolius.</i> <i>Hypnum reflexum.</i> <i>callichrous.</i> <i>Grimmia spiralis.</i> <i>ovata</i> var. <i>alpestris.</i> <i>Timmia megapolitana.</i> <i>Bryum polymorphum</i> , var. <i>curvisetum.</i> <i>alpinum.</i> <i>capillare</i> var. 3. <i>Bartramia ithyphylla.</i> <i>Gymnostomum curvirostrum</i> <i>Hypnum dimorphum.</i>	<i>Gymnomitrium concinnatum</i> <i>Jungermannia albicans</i> var. <i>trichophylla.</i> <i>Mastigobryum deflexum.</i>	<i>Peltigera crocea.</i> <i>Lecidea Wahlenbergii.</i> <i>Parmelia ventosa.</i> { <i>Lecidea Morio.</i> <i>Parmelia badia.</i> <i>Biatora decipiens.</i>
<i>Zona subalpina.</i> (=Z ₂). 4200'.	{ <i>Hypnum dimorphum.</i> <i>Starkii.</i> <i>Bryum acuminatum.</i> <i>Zierii.</i> <i>capillare</i> var. 2. { <i>Hypnum Crista-castrensis</i> <i>uncinatum.</i> <i>Schreberi.</i> <i>salebrosus.</i> <i>Halleri.</i> <i>subtile.</i> <i>Isothecium striatum.</i> <i>Bartramia Halleriana.</i> <i>Trichostomum glaucescens.</i> <i>Campylopus longirostris.</i> <i>Grimmia elatior.</i> <i>Gymnostomum rupestre.</i> <i>Ptychomitrium polyphyllum.</i> <i>Grimmia ovata.</i>	<i>Mastigobryum deflexum.</i> { <i>Jungermannia trichophylla</i> <i>curvifolia.</i> <i>reclusa.</i> <i>Scapania apiculata.</i> <i>Jungermannia nana.</i> <i>sphærocarpa.</i> <i>lanceolata.</i> { <i>riparia.</i> <i>acuta.</i>	<i>Cetraria juniperina.</i> <i>Parmelia ventosa.</i> <i>Biatora lurida.</i> <i>Umbilicaria pustulata.</i>

4200'.	MUSCI.	HEPATICÆ.	LICHENES.
Zona montosa (= Z ₁). Superior.	Pterogonium filiforme. { <i>Leskea attenuata</i> . Entodon insidiosus. <i>Hypnum rugosum</i> . <i>abietinum</i> . <i>catenulatum</i> . Bryum elongatum. { <i>Dicranum polycarpum</i> . <i>Rhabdoweisia fugax</i> . { <i>Orthotrichum Hutchinsiae</i> <i>rupestre</i> . <i>Tortula paludosa</i> . <i>Trichostomum tortile</i> . <i>Grimmia leucophæa</i> . <i>Fissidens grandifrons</i> . <i>Bryum obconicum</i> . <i>Hypnum crassinervium</i> .	Plagiochila Pyrenaica. { <i>Jungermannia acuta</i> . <i>Wilsoniana</i> .	{ <i>Parmelia fulgens</i> . <i>crassa</i> . { <i>Lecidea candida</i> . <i>vesicularis</i> . <i>Verrucaria maxima</i> . { <i>Opegrapha cerebrina</i> . <i>Verrucaria Dufourei</i> .
	{ <i>Isothecium repens</i> . { <i>Hypnum Haldanianum</i> . <i>pratense</i> . <i>Teesdalii</i> . { <i>Leucodon sciuroides</i> . { <i>Dicranum montanum</i> . <i>Tortula revoluta</i> . <i>chloronotos</i> . <i>Bryum atropurpureum</i> . <i>Grimmia crinita</i> . <i>Fissidens incurvus</i> .	{ <i>Jungermannia Wilsoniana</i> . { <i>Southbya tophacea</i> .	
Planties. (= Z ₀). 0000'.	<i>Hypnum illecebrum</i> . <i>Leptodon Smithii</i> . <i>Bryum torquescens</i> var. <i>Tozeri</i> . <i>Muelleri</i> . { <i>Entosthodon Templetoni</i> . { <i>Tortula cuneifolia</i> . <i>Trichostomum subulatum</i> .	<i>Jungermannia Francisci</i> . { <i>Saccogyna viticulosa</i> . { <i>Mastigobryum trilobatum</i> . <i>Reboulia hemisphærica</i> . <i>Riccia fluitans</i> . <i>natans</i> .	<i>Parmelia chrysophthalma</i> . <i>rubiginosa</i> . <i>Clementiana</i> . <i>Opegrapha elegans</i> . <i>Lyellii</i> .

It was my intention to have given here a comparative view of the distribution of Musci and Hepaticæ in the Pyrenees and in the other great mountain-ranges of the world, as also with that of our own islands, but this introduction has already swelled to a tedious length, and I hasten to close it with a few general observations.

As there are certain flowering-plants which accompany the habitations of men and of cattle from the plains nearly to the tops of the mountains, namely, in the Pyrenees, *nettles*, *mallows* and *docks* (*Rumex Patientia*); so there are likewise certain mosses which cling with equal tenacity to these traces of civilization.

The most notable are *Ceratodon purpureus* and *Funaria hygrometrica*. *Tortula ruralis* is associated with these until in the inferalpine zone it meets and is supplanted by *T. aciphylla*, which I have never seen away from the sheep-cotes and the huts of the shepherds. At about the same height *Hypnum rutabulum* and *Bryum capillare* give place to *Hypnum plicatum* and *Leskea incurvata*; these last, along with *Tortula aciphylla*, indicate the localities where the domesticated animals have taken up their temporary sojourn, throughout all the higher mountains.

The cryptogamic vegetation of the Pyrenees, taken in the *mass*, has great general resemblance to that of our own islands, especially of Ireland, and the species common to both attain nearly the same *comparative* altitude. Yet there are features in the former which would forcibly strike a bryologist accustomed only to the mosses of the British Isles. About the foot of the Pyrenees he would be struck with the luxuriant fructification of *Dicranum glaucum* and *Leucodon sciuroides*, the fruit of the latter being one of the greatest rarities of our islands; and he would equally remark the absence of *Bryum cæspitium*, of which I gathered only a single tuft, on a wall near Oloron; nor has it been observed elsewhere in the Pyrenees, though we are accustomed to look on it as the commonest of mosses. *Bryum cernuum* and *inclinatum* are almost equally scarce, though frequent with us and ascending high into the mountains. Were he next to climb the lower calcareous hills, he would see *Hypnum rugulosum*, *abietinum*, and *Leskea attenuata* profusely covering the scattered stones and rocks, and forming quite a marked feature even in the scenery. But he would miss *Hypnum undulatum* and the *Sphagna* which ornament our moist turfy hills; and if he ascended higher, he would probably see no *Splachna* or *Andreaeæ*. The rarity of the latter cannot be attributed to the southern latitude of the Pyrenees, for they exist even under the equator, as for instance on Mount Pichincha. The abundance of these two genera in the Alps of Switzerland must give a character to their vegetation wanting in the Pyrenees; and in general the Alps would seem to be much more *mossy* than the Pyrenees, *above* the region of forests, giving birth for example to an immense number of *Brya*, which in the Pyrenees are nowhere abundant above the inferalpine zone. This may reasonably be attributed to the more northerly position of the Alps, to their extending through a far wider zone of latitude, and not consisting like the Pyrenees of a single narrow chain; and to their greater humidity, which is probably dependent on the immense breadth of snow that perpetually covers them. The species described in this catalogue as new have none of them been observed in the Alps, with the exception of *Hypnum Pyrenaicum*, which was the only one noticed

above the subalpine zone; and there are a few other Pyrenæan mosses wanting to the Alps*.

Two *Jungermannia* exceedingly common in Britain, *Lophocolea bidentata* and *heterophylla*, are all but absent from the Pyrenees; and two others, *Jungermannia barbata* and *Ptilidium ciliare*, great ornaments of our mountainous districts, are altogether wanting. The latter attains its southern limit in the north of Italy; it is distributed throughout middle and northern Europe, but grows in greatest luxuriance within the Arctic circle. (Conf. Wahlenberg and the accounts of our Northern voyagers.)

According to Wahlenberg, there are in Lapland, as in the Pyrenees, extensive forests of *Pinus Abies* and *P. sylvestris*, and both descend into the plain; the former cease at the altitude of 800 feet and the latter at 1200 feet, indicating respectively the upper limits of the "regio sylvatica" and the "regio subsylvatica." But in the Pyrenees these trees ascend proportionally far higher than in Lapland; and that they do not occupy the same climatal zones we shall see by comparing the positions of a few mosses common to both countries. In the Pyrenees, *Tortula tortuosa*, *Bryum crudum*, *Didymodon capillaceus* and *Dicranum virens* are found in the region of coniferous trees, and are rarely seen above it; but these are precisely species mentioned by Wahlenberg as characteristic of his "Alpes inferiores," which are above the region even of the birch ("regio subalpina, Wahl."), and are characterized by the presence of *Betula nana*, *Diapenzia lapponica* and *Silene acaulis*. Yet the comparative altitudes attained by the mosses in the Pyrenees and in Lapland accord very nearly, and the species which ascend highest in the one for the most part do the same also in the other. Hence the zone occupied by a moss common to both has probably in both the same average æstival temperature.

[To be continued.]

XI.—*Algæ Orientales*:—*Descriptions of new Species belonging to the genus Sargassum*. By R. K. GREVILLE, LL.D. &c.†

[Continued from vol. ii. p. 434.]

[With a Plate.]

WIGHTIANÆ.

10. *Sargassum porosum* (nob.); caule cylindraco, brevissimo, muricato, ramis planis; foliis ovato-oblongis, subundulatis, inciso-

* The number of species which I have found in the Pyrenees new to the flora of France is considerable; but I cannot give a correct list of them, as I have not the dates of several species discovered in the Alps and Jura and nearly contemporaneously in the Pyrenees.

† Read before the Botanical Society of Edinburgh 14th Dec. 1848.

dentatis, uninerviis; vesiculis sphæricis breviter petiolatis; receptaculis minutis, axillaribus, cylindræis, oblongis, inermibus, subracemosis.

Hab. in mari Peninsulæ Indiæ Orientalis; Shuter (1827), Wight.

Root an expanded cartilaginous disc. *Stem* cylindrical, very short (in the only specimen I possess scarcely half an inch), about the thickness of a blackbird's quill, muricate. *Primary branches* few, 12–18 inches or more long, simple or sparingly divided, flat, a line or more broad, giving off the secondary branches in a distichous manner at intervals of about half an inch; these are from 3 to 6 inches long, and closely set with fruit-bearing ramuli likewise distichously arranged, and from half an inch to an inch in length. *Leaves*; those of the young primary branches, especially near the base, an inch long, ovate-oblong, sometimes ovate-lanceolate, somewhat undulate, deeply, and very irregularly inciso-dentate; those on the secondary branches half the size above-mentioned, and those accompanying the fructification minute and somewhat cuneate; all furnished with a slender nerve becoming faint and disappearing before reaching the apex, and with abundance of oval pores. *Vesicles* spherical, on stalks scarcely a line long; those accompanying the leaves on the young primary branches considerably larger than the seed of *Lathyrus odoratus*; those on the smaller branches and those intermixed with the receptacles much less. *Receptacles* axillary, about a line long, cylindræous, linear-oblong, obtuse, unarmed, forming irregularly divided clusters. *Colour* a rich red-brown, the younger leaves paler and somewhat translucent. *Substance* membranaceous, slightly rigid when dry.

This species is allied to *Sargassum incisifolium*, Ag., found at the Cape of Good Hope, but differs in the entire receptacles besides other characters. In an old state the branches lose their leaves and seem covered with the little tufted racemes.

The specimen which I possess from Dr. Shuter was kindly communicated by Sir W. J. Hooker.

11. *Sargassum elegans* (nob.); caule filiformi, teretiusculo, ramosissimo; foliis lineari-oblongis, obtusis, laciniato-dentatis, inferne oblique attenuatis; vesiculis parvulis, sphæricis; receptaculis lineari-oblongis, subcompressis, apicem versus dentatis, racemosis.

Wight in herb. no. 15.

Hab. in mari Peninsulæ Indiæ Orientalis; Wight.

Plant probably between 1 and 2 feet long; the specimen before me being fully 12 inches of the upper extremity, the whole of which bears evidence of having been covered with branches. *Root* I have not seen. *Stem*, or probably more correctly *primary branch*, filiform, about double the thickness of a hog's bristle,

giving off spreading branches 3–4 inches long, at intervals of half an inch, which become gradually shorter upwards, thickly covered with leaves, vesicles and receptacles. *Leaves* linear-oblong, or, sometimes, oblong-lanceolate, nearly three-quarters of an inch in length, 2–3 lines broad, obliquely attenuated at the base into a very slender petiole, sharply inciso-dentate, or even laciniate, furnished with a delicate nerve and oval pores. *Vesicles* numerous, spherical, the largest not half the size of the seed of *Lathyrus odoratus*, most of them as small as an ordinary pin's head, often apiculate, and the apiculus excentric, furnished with a few papilliform pores, and supported on a little compressed stalk not a line in length. *Receptacles* axillary, cylindraceous or subcompressed, oblong or somewhat club-shaped, sharply toothed, and forming little racemose tufts about a line and a half long. *Colour* dull reddish brown. *Substance* somewhat membranaceous and slightly diaphanous.

A very beautiful species. When dry, the laciniate teeth of the leaves give them quite a fringed appearance.

12. *Sargassum brevifolium* (nob.); caule teretiusculo, muricato; foliis parvulis, obovatis, dentatis, uninerviis; vesiculis minutis, sphaericis; receptaculis filiformibus, elongatis, racemosis.

Wight in herb. no. 20.

Var. β; foliis laciniato-dentatis, in petiolo longiore attenuato. An species distincta?

Wight in herb. no. 10.

Hab. in mari Peninsulæ Indiæ Orientalis; Wight.

Root I have not seen. *Stem* (or *primary branch*?) probably 2 feet long or more; but only fragments are in my possession; cylindraceous, somewhat muricate. *Branches* 4 or 5 inches long, thickly clothed with the fructiferous ramuli, which are not more than half an inch in length. *Leaves*; those on the main branches I have not seen; those on the secondary branches, from the axils of which the clusters of receptacles and vesicles arise, are about a third of an inch long, more or less obovate, remotely dentate, rounded at the end, furnished with pores and a nerve which soon becomes rather faint and disappears below the summit. *Vesicles* spherical, numerous, the size of a large pin's head, having prominent pores, supported on filiform stalks half a line in length, and arising from the lower ramifications of the raceme. *Receptacles* numerous, filiform, elongated, forming much-divided racemes from a quarter to half an inch long. The receptacles are not unfrequently foliaceous towards their upper extremity, in which case they resemble linear leaves toothed at the margin, and are furnished with a nerve and pores. *Colour* reddish black when dry. *Substance* cartilaginous.

In variety β . the stem is more muricate. The leaves smaller, and besides being inciso- or laciniato-dentate, they are attenuated more gradually into a longer and more slender stalk. The receptacles are smaller, but present no other perceptible difference.

In the absence of more perfect specimens, and indeed of a larger series, the present description must necessarily be imperfect. The plant I have considered as a doubtful variety bears a great resemblance to the other, yet I might perhaps with some reason have raised it to the rank of a species; the striking similarity of the fructification alone deterred me. Should it prove distinct, it may bear the name of *S. pergracile*.

EXPLANATION OF PLATE IV.

Sargassum porosum.

- Fig.* 1. Leaves and vesicles on the young plant.
 — 2. One of the lower leaves.
 — 3. Leaves and vesicles on the fertile branches.
 — 4. Leaves of the ramuli with receptacle.
 — 5. Portion of a branch with old racemes, after the leaves and vesicles have disappeared. The two last magnified.

Sargassum elegans.

- Fig.* 1. A branch.
 — 2. Leaf from ditto.
 — 3. Raceme.
 — 4 & 5. Raceme.
 — 6. Vesicles. 2, 4, 5 and 6 magnified.

Sargassum brevifolium.

- Fig.* 1. Lower portion of a branch.
 — 2. Raceme of fructification, with vesicles.
 — 3. Raceme, vesicles and leaf.
 — 4. Vesicle.
 — 5. Portion of var. β .
 — 6. Leaves of ditto. 3, 4 and 6 magnified.

XII.—*Observations on the Minute Structure and Mode of Contraction of Voluntary Muscular Fibre; being the abstract of a Paper read before the Royal Medical Society, Edinburgh, December 15th, 1848.* By W. MURRAY DOBIE, F.B.S.E.

[With a Plate.]

THE structure of cross-striated muscle is a subject which has more or less engaged the attention of minute anatomists, since the first introduction of the microscope as a means of histological research.

There is perhaps no animal texture as to the nature of which more contrary opinions have been held, or more conflicting state-

ments advanced, than that of voluntary muscle, so that even at the present time it must still be considered a question by no means set at rest.

My object in the present communication is to state briefly the opinions which a careful examination of this texture in several animals has led me to adopt, confining my observations to the elementary fibre, independent of its sarcolemmal sheath.

Before proceeding to do so, I shall very shortly notice the opinions of the principal microscopic anatomists who have been employed in this investigation.

Robert Hooke and Leuwenhoek were the first to examine muscular fibre with the microscope. Robert Hooke speaks of the "fibres resembling a necklace of pearl;" it is probable that by fibres he means the ultimate fibrillæ.

Leuwenhoek saw and figured the transverse striæ, which he regarded as only surface-markings produced by the windings of a spiral thread. He considered the fibre to be composed of globules, less in size than the corpuscles of the blood. He made cross-sections of the fibres, and showed them to be polygonal and surrounded by areolar texture.

Malpighi, in an isolated passage of his works, notices the transverse striæ. De Heide also described and figured them.

In the large work of Muys, which appeared in the middle of the last century, the author describes muscle with great care; he was evidently acquainted with the transverse striæ, and figured the fibrillæ, which he terms "fila," and describes as "nonnunquam etiam nodosa" (Pl. VII. fig. 1 a b c d). The nodose appearance would seem to have perplexed him, and he considered it not universal. Muys was well-aware of the solidity of the elementary fibres, and his drawings of cross-sections of muscle are well-worthy of examination.

Prochaska wrote an excellent treatise on muscle*; he supposed that the markings seen on the surface of a muscular fibre were caused by the lateral pressure of vessels, nerves or fibres. He injected muscle very successfully, and found the vessels so numerous, that he attributed the contraction of muscle to the distension of these vessels throwing the fibre into zigzag flexures.

Fontana, in his treatise "On the Venom of the Viper†," makes some short but excellent observations on muscular fibre; he was the first anatomist who ascribed the transverse striæ to the lateral coaptation of the sarcal elements of the fibrillæ. He thus speaks of the fibrillæ:—

"Les fils charnus primitifs sont des cylindres solides, égaux entr'eux, et marqués visiblement à distances égales de petits signes, comme d'autant de petits diaphragmes, ou rides. Je n'ai

* De Carne Musculari.

† Sur le Vénin de la Vipère, 1781.

pû apercevoir dans ces fils une marche vraiment ondée, et il m'a paru que les petites taches curvilignes du faisceau primitif étoient formées par les petits signes, ou diaphragmes, des fils charnus primitifs." (Pl. VII. fig. 2.)

Sir Everard Home and Mr. Bauer took up the microscopical investigation of muscular fibre in 1818 and again in 1826. Unfortunately for science they fell into remarkable errors. Their observations retarded rather than advanced the microscopical anatomy of muscle, and raised doubts as to the credibility of any conclusions drawn from microscopical observations.

Sir Everard Home and Mr. Bauer*, seeing the tendency which blood-corpuscles have to unite in a longitudinal series, fancied it highly probable that the fibrillæ of striated muscle were formed in the same manner. Sir Everard states that the particles of the fibrillæ are of the same diameter as the blood-corpuscles deprived of their colour; he supposes Leuwenhoek's assertion, that muscle is composed of globules of less diameter than the blood-corpuscles, incorrect, and he endeavours to account for this supposed mistake by adducing the fact, that Leuwenhoek never possessed a micrometer.

Mr. Skey, in a paper in the 'Philosophical Transactions,' sets forth as his opinion, that each muscular fibre is a tube, containing in its interior a semi-transparent amorphous substance; the tube he supposes to be composed of fibrillæ, and the transverse striæ to be depressions on the surface of the fibre.

The views of Müller, Schwann, Lauth and Henle are very similar to those advanced by Fontana.

Schwann considers the fibrillæ to be beaded filaments, presenting under the microscope a succession of dark points separated by light and somewhat narrower portions of the fibril.

Dr. Martin Barry holds the structure of muscle to be spiral; he says each fibril is composed of two spirals coiling in opposite directions.

From these observers I shall pass to those who in recent times have examined the fibrillæ of muscle, with a view to determining the real constitution of these filaments.

The publication of Mr. Bowman's paper in the 'Philosophical Transactions' was an æra in the microscopy of muscle, though he does not seem to have been able to make out the ultimate constitution of the fibrillæ, which he considered were composed of a series of highly refracting particles of one kind; he thus describes them:—

"Fibrillæ present alternate dark and light points when the

* Philosophical Transactions, 1818 and 1826.

part is a little out of focus. The light parts are the centres of highly refracting particles acting as lenses; the dark points the intervals between them. If now the focus be carefully adjusted and the achromatic condenser be used for the purpose of defining the outline with the utmost precision, each dark interspace between the refracting points will be found to be reduced to two very slender straight lines, crossing the fibrillæ in a transverse direction, and giving the light spaces as now seen a rectangular figure." (Fig. 3 *a b*.)

Dr. Sharpey, from an examination of Mr. Lealand's preparations of the muscle of pig, considers the sarcal particles each to be composed of a dark central and clear outer part. Dr. Sharpey mentions that Mr. Lealand himself first pointed out a cross line in the clear interval, and also the bright surrounding areas (fig. 4 *a & b*).

Dr. Carpenter examining the same dissections comes to a similar conclusion (fig. 2 *b*).

Professor Allen Thomson of Glasgow, in his late work on Physiology, describes the structure of the fibrillæ in the same way as Dr. Sharpey: but since the publication of that work he has been led to doubt the existence of any lateral clear edge, as he himself has informed me.

Mr. Erasmus Wilson, from an examination of Mr. Lealand's preparations, which he is pleased to call his "own investigations," describes the fibrillæ very differently; he does not represent any clear lateral edge to the fibril; he considers the clear as well as the dark space to be severally composed of a pair of cells, the dark pair containing a denser "*myoline*" than the clear pair; each of these cells is again subdivided into two, thus giving four square cells of equal size in each dark or light interval (fig. 5 *a & b*).

I shall now advert to my own views regarding this structure, which I have deduced from the examination of very numerous demonstrations of the fibrillæ, which I have succeeded in making in several kinds of muscular fibre, generally in the perfectly fresh state.

When a favourable specimen of the muscular fibrillæ of the frog, pig, or ox, is placed under a microscope magnifying about 500 diameters, and the focus is adjusted with great care to the point at which the fibrillæ can be seen with the greatest distinctness, or at what I shall term the *distinct focus*, the appearance presented is the following:—The fibrillæ are seen to be divided equally into a series of quadrangular spaces or areas, which are observed to be of two kinds, the one dark, the other clear or light, regularly alternating with each other. The

clear area may be observed in favourable specimens to have a distinct edge, and when the fibril has been in no way distorted or stretched, to be continuous with the edge of the dark area. Crossing the clear space at its centre, and at right angles to the length of the fibril, will be seen a distinct dark line; this line divides the clear area into two equal parts or divisions, which are necessarily quadrangular. The dark space in the same focus presents a shape very similar to the clear one, though generally of a more elongated form; its whole surface is dark, with the exception however of a clear line crossing it in the same manner as the dark transverse line does the clear space, and dividing it equally into two dark particles (fig. 6 a).

In some cases I have seen the dark spaces divided into *three* by two clear cross-lines; an appearance I think which cannot be relied on, as the other dark spaces in the same fibrils presented the space as double only, with the single clear transverse line.

When the fibrils are stretched, the dark space often appears as if somewhat elevated above the clear space; I have seen this very distinctly in stretched fibrils from the lobster, examined very shortly after death, the clear space having scalloped edges (fig. 7 a).

With regard to the term *dark space*, it must not be supposed that it is really *opaque*; for under a *superficial* focus it also becomes *clear*, as I shall presently describe. I shall still retain the term as expressive of what is observed when the fibril is seen under the *distinct* focus.

If the focus of the instrument be now adjusted for the more superficial part of the fibril, or a little above it, a remarkable change is observed; the general appearance of the fibril is diminished in distinctness, and what was before the dark space now appears clear (but not so translucent as the clear space in the *distinct focus*), and is then seen to be crossed transversely by a dark line (fig. 6 b).

The clear area or space undergoes a similar change of appearance, becoming quite dark, but no line can be observed to cross it. The focus under which this is observed, to avoid confusion I shall call the *superficial focus* (fig. 6 b).

It will perhaps be considered trivial thus to describe the appearance of the fibrillæ under an indistinct focus: but that it is not so, I hope afterwards to be able to prove; for on the change of appearances thus presented, I believe hangs the true explanation of the cause of the transverse striæ of voluntary muscle.

In some kinds of muscular fibrillæ, it is a matter of great difficulty to perceive any dark transverse line in the clear space:

this arises from the extremely small size of this space, especially when the fibril is in a relaxed condition, and is more particularly found in the examination of the muscular fibrils of fish, lobster or crab, in which indeed this line can be *very rarely* seen (fig. 7 *b*). Hence most probably the reason why Mr. Bowman does not represent it. In such cases the only way to obtain a view of it is by stretching the fibril when in a perfectly fresh state; this cross-line of the clear space in the lobster partook more of the nature of a *band*, in the cases where I was enabled to examine it (Pl. VII. fig. 7 *a*). In the fish (salmon) I have only seen it in a few cases, but in these the appearance was so distinct as not to leave the least doubt of its existence.

I am not aware that this cross-line in the lobster, salmon, skate and frog has been seen by any preceding observers. In the pig and human subject it has been seen; I have also distinctly observed it in the muscular fibrillæ of the ox.

The length of the dark and clear spaces is sometimes identical; at other times, and more frequently, the clear space is shorter; and in the lobster and salmon is often so narrow as to be diminished to a somewhat dark line when the fibril is in a perfectly relaxed condition.

I have also frequently observed, in dissections of the muscular fibrillæ of the frog and salmon, an appearance which I consider it important to mention, the true explanation of which I am at present unable to decide upon. It is as follows:—At the point where two fibrillæ are separated from each other, extended for a greater or less distance between them, there often exists a beautiful homogeneous membrane, (resembling the web between two of the toes of a duck,) which is stretched by the violence used in the separation of the fibrillæ (fig. 8 *a*). In some recent observations which I have made on the muscular fibres of the skate when perfectly fresh, this appearance invariably presented itself, with this peculiarity however, that instead of being perfectly homogeneous, it was marked with stripes corresponding to the dark and light spaces of the fibrillæ between which it was stretched (fig. 8 *b*).

I was at first inclined to regard this membrane as a shred of the sarcolemma accidentally stretched out between two fibrillæ; but from its being of a decidedly more delicate nature than that membrane, and from its being present in nearly every part of some preparations, I am inclined to consider it as being caused by some homogeneous connecting medium spread among the fibrillæ.

The striæ in this membrane in the skate I am at a loss to account for; perhaps from the tearing of the membrane over the

fibrillæ, the surface of the membrane may have been thrown into delicate rugæ by the elevation of the dark spaces above the clear ones, as may be often seen in stretched fibrils.

I have seen appearances in the skate that would almost lead to the belief that this membrane was a fibril spread out laterally into a membrane; this would quite account for the striæ on its surface. The subject requires more investigation.

The form of the fibrillæ I consider to be somewhat flattened or ribbon-shaped; this can be easily seen when an isolated fibril becomes accidentally twisted.

The conclusions which I would draw with regard to the structure of muscular fibre from what I have myself observed, I shall now endeavour to give.

1. That (excluding the sarcolemma) an ultimate fibre of voluntary muscle is composed of two kinds of sarcoous matter, arranged in a definite manner, having a tendency under certain circumstances to split up into fibrillæ (Pl. VII. fig. 9), very rarely into discs, and then generally after prolonged maceration in spirit. The fibrillæ are divided into *dark* and *light* spaces.

2. That the dark sarcal element or space has some peculiarity in its molecular arrangement, differing from the clear sarcal element or space, which causes it to refract light in a different way. That we are not entitled to say that it is composed of cells *containing a fluid* of greater density than that contained in the contiguous clear space; in fact, that we are not able to say with any degree of certainty, that any portion of a muscular fibril in the mature state is a cell containing fluid, as Mr. Erasmus Wilson believes.

3. That the clear space can be distinctly seen to have a dark line crossing it transversely and dividing it into two equal parts, and that the dark space also presents a similar division caused by a line which is generally seen of a lighter shade than the other parts of the same space, and not a broad black band as is erroneously represented by Mr. Erasmus Wilson (fig. 6 *a* & fig. 5 *a*).

4. That no clear area exists at the edge of the fibrillæ extending transversely outwards from the dark spaces, giving the fibrillæ the appearance of a chain of nucleated cells, as is represented by Dr. Sharpey and Dr. Carpenter (fig. 4). This conclusion I have been irresistibly led to by the following considerations:—

- a.* The fact that when two fibrillæ lie side by side, the edges of the black spaces are in accurate apposition.

- b.* That if this lateral clear area really existed, the fibre would be spotted, or at least marked with longitudinal striæ quite as distinct as the transverse ones, which in this case would not be well-marked (fig. 4 *a*).

c. That the edges of the clear space can be seen under a fine instrument not to extend farther laterally than the edges of the dark space (fig. 6 a).

[I perceive Mr. Quekett in one of the plates to his recent work on the Microscope has distinctly represented this, though he gives an incorrect diagram to explain an appearance which he represents quite correctly.]

d. That the cross-line in the clear space measures exactly the same as the breadth of the dark space, and that it can be distinctly seen in favourable cases to touch the edges of the clear space (fig. 6 a).

5. That it seems probable that there exists a homogeneous connecting medium among the fibrillæ (fig. 8 a & b).

6. That the structure of cross-striated muscular fibre is essentially the same in all the members of the animal kingdom.

7. That from all I have seen of the structure of voluntary muscle, I am perfectly certain that the appearances presented are quite inconsistent with any *palpable* spiral arrangement, either in the fibre or fibrillæ, as is still the opinion of Dr. Martin Barry. Mr. Bowman's observations ought to have set this point at rest.

8. That the dark spaces become clear, and clear spaces dark, during a change in the focus of the instrument, causing a peculiar appearance of movement on the fibrillæ (fig. 6 a & b).

9. That the clear spaces are generally narrower in the fish and lobster than in the frog and mammalia (fig. 6 a).

10. That the fibrillæ are somewhat flattened bands.

11. That the dark spaces in some cases appear as if slightly elevated above the clear spaces of a fibril (fig. 7 a).

The transverse striæ.

The transverse striæ, when observed with great care and during rapid though slight alterations of the focus, are seen to undergo some change in appearance; a kind of shifting a short space backwards and forwards. This appearance I explain in the following manner.

The muscular fibrils being composed of a series of clear and dark particles, which under change of focus alter from dark to clear and from clear to dark, this change also takes place under the same circumstances in the complete fibre, so that the dark transverse striæ are at one time formed by the lateral coaptation of the dark spaces, at another time by a like coaptation of the clear spaces.

I see no other way of explaining this peculiar appearance of movement on the surface of the fibre during alterations of focus in a rational manner, and I believe that Mr. Erasmus Wilson is

wrong in stating that the dark transverse striæ are always formed by the lateral union of the *light* spaces.

This appearance of movement cannot be caused by dark spaces of fibrillæ lying immediately below the *clear* spaces of a set of fibres which are *superficial* to them. As the movement can be seen in a perfectly fresh and undisturbed fibre, it can also be seen on the individual fibrillæ, as I have already stated.

The contraction of voluntary muscle.

Hales, Prevost and Dumas, from observations made on the abdominal muscles of the frog, considered the contraction of muscle to be due to zigzag flexures taking place in each fibre. Prevost and Dumas imagined it to be an electrical effect of the passage of nervous cords across the fibre at the angles of flexure.

Professor Allen Thomson repeated the experiments of Hales, Prevost and Dumas, and was led from the observations he then made to consider that the zigzag plicæ were not produced until the contraction had ceased in the fibres which were the subjects of it; he observed single fibres continuing in contraction, being simply shortened and not falling into the zigzag flexures. Professor Owen was also led to doubt the accuracy of the statements of Prevost and Dumas from noticing that during the contraction of unstriated muscles in some *Filarias* and in a *Vesicularia*, a swelling took place in the centre of the fibre which thus became shorter and thicker.

Dr. A. Farre observed a similar fact in the unstriated muscles of the *Polypifera*.

The admirable researches of Mr. Bowman have left us little to wish for with regard to the nature of the contraction; I refer to his observations published in the 'Philosophical Transactions' for 1842. All his observations were made on muscular fibres of animals shortly *after death*.

I shall briefly allude to some observations made with reference to this subject on the living and uninjured tadpole.

In April this year (1848), when observing the circulation in the tail of a tadpole after the disappearance of the gills, I was surprised on noticing that the cross-striated muscular fibres were distinctly visible through the external tegument; the contractions after the animal was somewhat exhausted were slow and beautiful, not uniform throughout, as is the case when the tail is observed immediately after the death of the animal and stripped of its integument: the former is the active, living and voluntary, the latter the passive contraction.

When the contraction was comparatively slow, the approach of the transverse striæ could be seen with extreme distinctness; the

relaxation was as instantaneous as the contraction in that part of the fibre which was the subject of it.

The circulation of the blood was visibly accelerated after a rapid series of contractions; the blood seemed to be pressed out of the vessels of the part undergoing contraction; on relaxation taking place the afflux was immediate.

These observations were made at a time when I was much engaged with other matters, and are consequently very imperfect. I hope to be able to resume the inquiry during the ensuing spring, when these interesting animals can be obtained in a proper state for the examination. I believe this is the first observation of the contraction of a cross-striated muscle, so high in the scale of being as the *Batrachia*. I may mention that Dr. Allen Thomson repeated my experiments on the tadpole about the same time and with similar results.

Among the *Rotifera* I have observed very beautiful examples of cross-striated muscle, more especially in the *Euchlanis triquetra* and in the *Euchlanis Hornemanni*, which are not uncommon species; the approach of the transverse striæ is very marked. The relaxed fibres are subject to a degree of zigzag flexure when other muscles of the animal are in action.

In conclusion, one word on the mode of displaying or separating fibrillæ from the mass of a fibre, which is unquestionably a very difficult operation. Mr. Lealand the optician seems to have almost completely monopolized this branch of minute dissection, as nearly the whole of the best preparations extant are from his hands. I am not aware that he has yet made known his mode of procedure to the public.

If a muscular fibre of the salmon be used, it is in general not very difficult to separate the fibrillæ in water. Allowing it to remain in moderately strong spirit for a short time, not only removes the oil-globules from around the fibre, but greatly facilitates the dissection; it may then be mounted in the usual way, in spirit, or what perhaps answers better, in glycerine diluted with about three times its bulk of water.

The most characteristic specimens are obtained with greatest ease from the frog, the size of the fibres rendering them very easy to manipulate. Allow the leg of a frog stripped of integument to remain in moderately strong spirit for about two hours, then commence the dissection with extremely fine needles set in long handles. The largest fibres should be selected. After a few trials the rudest operator can scarcely fail to separate the fibrillæ.

The muscular fibres of the skate, treated in the same manner, afford easily-dissected and most characteristic examples of muscular fibrillæ.

EXPLANATION OF PLATE VII.

Fig. 1. *a b c d*, four figures of fibrillæ after Muys.

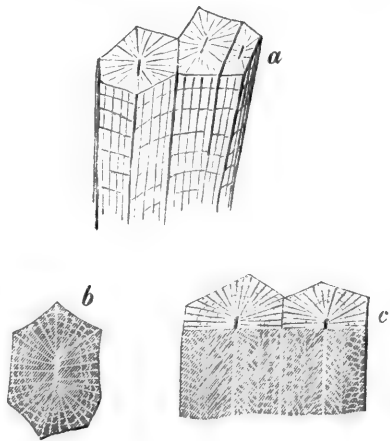
- 2. "A fibre covered with cellular membrane at the upper part," cross-striated and splitting up into fibrillæ at one end: after Fontana.
- 3. Diagram of fibrillæ after Bowman.
- 4. Diagram to illustrate the views of Sharpey, Lealand and Carpenter: *a*, two fibrils united; *b*, single fibril, with each sarcal particle having a dark central and clear outer part.
- 5. Diagram of two fibrillæ to illustrate the views of Mr. Erasmus Wilson: *a*, usual appearance of fibrillæ; *b*, a very much stretched fibril to show the dark and clear spaces, each divided into four.
- 6. Diagram to show the fibrillæ in the distinct and superficial focus: *a*, fibrils in distinct focus; *b*, fibrils in superficial focus from the frog.
- 7. Diagram of two fibrils from the lobster: *a*, fresh fibril much stretched, showing scalloped edges of clear space; *b*, similar fibril unstretched, showing clear space apparently dark from its narrowness.
- 8. Diagram to illustrate a membrane observed among the fibrillæ: *a*, membrane as seen in frog and salmon; *b*, similar membrane observed among fibrillæ of the muscle of skate, perfectly fresh.
- 9. General appearance of a dissection of muscular fibre from the frog, magnified about 500 diameters.

XIII.—On some new genera and species of *Palæozoic Corals and Foraminifera*. By FREDERICK M'COY, M.G.S. & N.H.S.D. &c.

[Continued from p. 20.]

Stylaxis (M'Coy), n. g.

Gen. Char. Corallum composed of adjacent polygonal, prismatic, easily separable tubes, internally divided into three areas: *vertical section*, 1st, a thin, flat, straight axis; 2nd, a broad inner area composed of numerous curved vesicular plates in irregular rows converging upwards to the axis; 3rd, an outer area on each side composed of smaller and more curved vesicular plates, in rows inclining obliquely upwards and outwards: *horizontal section* displaying the central flat axis surrounded by radiating lamellæ extending from the walls, and connected in the outer area by numerous transverse vesicular plates: *additional columns*



a. Mode of growth and division of stem; *b*. horizontal section; *c*. vertical section.

produced by a bipartite division of the parent stem parallel to one of its faces: polyps distinctly separated above.

The corals of this genus bear precisely the same relation to *Nemaphyllum* that *Stylastræa* (Lonsd.) does to the *Lithostrotion* of the same writer (*Strombodes*) with regard to their mode of development, that is to say, in *Nemaphyllum*, as in *Strombodes*, the increase is by circular buds developed within the walls of the parent stem, the polygonal walls being gradually perfected by the joint labour of adjacent polyps; which it is inferred from their mode of growth, had a community of existence and organic union at the surface, and from the same cause the columns have no outer surface to exhibit in a rough fracture, but break through the middle rather than separate one from another. In the *Stylaxis* however, as in the *Stylastræa*, the new columns are produced by a sudden splitting of one of the columns into two, the divisional lines commencing along the middle of one face and going directly across to the opposite face, distinctly separating the young four-sided column at once by a double-plated, rectilinear boundary-wall parallel with one of the faces; the external striæ of the old column being traceable upwards into the young one. The columns are easily separable one from another in the rough fracture, and the polyps are inferred to have been distinct from each other, and each to have constructed independently its own boundary-wall.

Stylaxis major (M'Coy).

Sp. Char. Tubes averaging 6 lines in diameter, mostly hexagonal, external surface coarsely striated longitudinally and transversely marked with strong curved irregularities of growth, the convexity of the curves upwards: *horizontal section*, sixty-three slender radiating lamellæ converging from the walls towards the flat central style or axis, which is about 1 line in width; one half of the lamellæ reach the centre, the intervening ones reach half way; outer area exhibiting numerous transverse vesicular plates between the radiating lamellæ: *vertical section*, axis straight, ribbon-like; inner area broad, of slightly curved vesicular plates forming rows of lengthened irregular cells, extending obliquely downwards and outwards from the axis, about three in a row; outer area of rows of small hemispherically-curved plates, including small rounded cells extending very obliquely upwards and outwards, about six in each row.

This species is remarkable for the large size of its tubes and great number of the radiating lamellæ.

From the carboniferous limestone of Derbyshire.

(*Col.* University of Cambridge.)

Stylaxis Flemingii (M'Coy).

Sp. Char. Corallum of very long, prismatic, generally hexagonal, easily separable tubes, averaging 3 lines in diameter; outer surface strongly striated longitudinally, and marked with direct transverse rugosities of growth; bipartite division of the columns frequent: *vertical section* exhibiting the thin flat axis surrounded by an inner zone of small vesicular plates inclining downwards and outwards from the axis, and an outer zone of small vesicular plates inclined in an opposite direction or upwards and outwards: *horizontal section*, axis thin, half a line wide, surrounded by about forty-three thin, radiating lamellæ from the walls, half of which only reach half way; numerous small, thin, transverse connecting plates between the lamellæ in the outer zone.

The bipartite mode of division of the column is frequently and easily observed in this species, which commonly forms large masses. It greatly resembles externally the *Stylastræa basaltiformis*, but is easily distinguished by the small, but distinct, central axis visible in the transverse fracture, and further by the different disposition of the lamellæ of the inner zone. The small size of the tubes and less number of lamellæ distinguish it from the *Stylaxis major*.

This is probably the *Lithostrotion striatum* of Fleming, (Brit. Anim.) as he particularly says, "the rays of the star unite with a small solid central axis." I think however with Mr. Lonsdale, that he is wrong in his references. I have great pleasure in dedicating it to so admirable a naturalist, the extraordinary merit of whose writings on the British marine animals is well known to all who engage in the same laborious and difficult study.

Common in the carboniferous limestone of Derbyshire.

(Col. University of Cambridge.)

Columnaria (Gold. as here redefined).

Gen. Char. Corallum of aggregate, subparallel branches, either round and concentrically wrinkled, or more usually by mutual pressure becoming polygonal and longitudinally sulcated, but always easily separable; internal structure as in *Amplexus*, having many transverse simple diaphragms, and the walls longitudinally sulcated by marginal rudimentary lamellæ, which crenulate the edges of the transverse plates. Increase by fissure of the parent tube or cell, as in *Stylastræa* (Lonsd.). Type of the genus *Columnaria sulcata* (Gold.).

This genus has been erroneously described by Goldfuss in the first instance, and has been misunderstood by nearly every subsequent author—all describing radiating lamellæ from the walls

to the centre, and stating that there are no transverse plates ; I was rather surprised therefore to find the characters I have given above, in authentic specimens from the Eifel of the *C. sulcata* (Gold.) ; they also exist in the *C. irregularis* (Münst.), *C. senilis* (Koninck), and the following. I deny the existence in those species of radiating lamellæ near the centre, and find the transverse diaphragms conspicuous. The real affinities of the genus seem to be between *Michelinea* and *Amplexus*, differing from the former in the tubes being individually distinct (as in *Stylastræa*) and easily separable by fracture, and being without communicating pores ; from the latter it only differs in its compound mode of growth. As thus restricted the genus is no doubt a good one : the other dissimilar species placed in this genus by Dr. Goldfuss and others will easily fall into *Cyathophyllum* and other existing genera.

Columnaria laxa (M'Coy).

Sp. Char. Corallum forming large masses of contiguous, slightly flexuous tubes, rarely in contact ; generally round and finely wrinkled transversely, occasionally the tubes in some part of their length touch the adjoining ones, and then become polygonal and longitudinally sulcated ; transverse diaphragms undulated, and obliquely inclined in various directions ; diameter of tubes from 3 to 4 lines.

The tubes being rarely in contact, and often cylindrical and flexuous, distinguishes this species from its congeners. The transverse diaphragms and absence of radiating lamellæ will serve to separate prismatic portions from the other basaltiform corals found with it.

Not uncommon in the carboniferous limestone of Derbyshire. (Col. University of Cambridge.)

Michelinea glomerata (M'Coy).

Sp. Char. Cells polygonal, irregularly aggregated, so as to open on every side of the large amorphous masses formed by its irregular mode of growth ; cells averaging 2 lines in diameter ; internal vesicular plates very irregular, much curved and highly inclined.

This is perhaps most allied to the Russian *M. concinna* (Lonsd.), but as that species is remarkable for the breadth, flatness and horizontality of its internal plates, so this is equally remarkable for their irregularity, convexity, small size, and nearly vertical position, forming in the sections a multitude of small rounded vesicles, without any approach to horizontality. The small size of the cells and mode of growth seem somewhat analogous in

both, and separate them at a glance from the three other published species.

Common in the carboniferous limestone of Derbyshire, forming subcylindrical masses 3 or 4 inches long.

(Col. University of Cambridge.)

Michelinea grandis (M'Coy).

Sp. Char. Corallum widely conic, the width considerably exceeding the height, externally marked with thick, rounded, radiating ridges, finely wrinkled across; polygonal cells, on the upper convex surface, averaging 5 to 8 lines in diameter (most near the former at a height of half an inch, most near the latter size at a height of 2 inches), very deep with thin walls not coated by vesicular plates, but having numerous distinct foramina and many longitudinal striæ within; internal vesicular plates small, very thin, much curved, forming nearly horizontal rows of vesicles at the bottom of the cells.

This fine species is most allied to the *M. tenuisepta* (Phil. sp.), but is distinguished by the much wider conical form of the mass and by the cells having, on an average, a diameter three times greater at the same height than in that species, of which I have examined many specimens both British and foreign, and find the figures of Michelin and Koninck, as well as of Prof. Phillips, exact in this respect. Young specimens (1 to 2 inches in diameter) slightly resemble the *M. favosa* (Gold. sp.) in form, having the base much flatter than in the adult, but on comparison with authentic Belgian specimens they are found to be distinguished by the large rounded radiating ridges on the exterior, of which no traces exist in that species, as may be also seen from the figures of Goldfuss and Michelin; the cells also of the present species are, even at that stage, larger, and increased growth destroys all resemblance. The *M. megastoma* (Phil. sp.), which has large cells (although much less than the present species), is distinguished by its mode of growth, it forming large flattened expansions; internally its vesicular plates are much larger, fewer, and highly inclined at the circumference, coating the walls of the cells to their very edge, giving them a peculiar thick tumid appearance, which may be imperfectly recognized in the worn specimen figured by Prof. Phillips, but which distinguishes even fragments from the other four species. Average height of the conical masses $2\frac{1}{2}$ inches, width $3\frac{1}{2}$ inches.

Very common in the carboniferous limestone of Arnside, Kendal.

(Col. University of Cambridge.)

Sarcinula (Lamk.).? = *Arachnophyllum* (Dana).

The corals of this genus are essentially composed of vertical, cylindrical, transversely septate tubes, with radiating lamellæ within, forming distant circular cells without polygonal boundaries; the tubes are imbedded in a uniform cellulose tissue, from which the buds or young tubes seem to arise whenever the distance becomes great between any two cells, but the young tubes do not seem traceable into the old. The coral referred to by Dana (*Acervularia Baltica* of Lonsdale in the 'Silurian System') as the type of his genus *Arachnophyllum*, I find to have the cell-tubes transversely septate, though not well shown in Lonsdale's figure—the latter genus has therefore no peculiar characters—the cellular structure of the rays being common to several corals.

Sarcinula tuberosa (M'Coy).

Sp. Char. Corallum forming large shapeless masses, the upper surface covered with irregular tuberoso projections, separated by flat or concave spaces, and each having a depressed tubular centre 1 line in diameter, average distance between the centres 5 lines; from the margin of each centre about thirty slightly sigmoidal, very delicate laminae radiate to the adjoining ones, generally without interruption, the radii connected by numerous small transverse vesicular plates: *vertical section*, centres forming nearly vertical and subparallel cylindrical tubes, with close transverse septa, connected by exceedingly fine uniform cellulose structure, which seems formed of small depressed cells arranged nearly in horizontal layers with a double curve conforming to the projections of the surface: *horizontal section* shows the tubular centres connected by a minute uniform cellular structure with a scarcely appreciable radiation.

This strongly resembles the so-called *Acervularia Baltica* of the 'Silurian System.'

Rare in the carboniferous limestone of Derbyshire.

(Col. University of Cambridge.)

Sarcinula placenta (M'Coy).

Sp. Char. Corallum forming tabular masses about 1 inch thick; under side with small, concentric, imbricating undulations of growth and radiating scratch-like striæ; the upper and lower surfaces parallel and flat, composed of vertical cylindrical tubes forming circular cells at the surface 1 line in diameter, and averaging about 2 lines apart; the intervening space being flat, cellular, and obscurely radiated on the weathered surface by

about thirty curved radii: *vertical section*, tubes irregularly transversely septate by vesicular plates; spaces between the tubes composed of slightly waved transverse rows of small, curved, vesicular plates, forming a nearly uniform, minutely cellular structure: *horizontal section*, tubes either plain or showing more or less of the transverse vesicular plates; intervening spaces irregularly cellular, but showing a slight disposition to form curved, star-like lines round the tubes.

This interesting coral bears a strong external resemblance to the *Nemaphyllum decipiens* (M'Coy), but is distinguished by having no divisional lines between the stars in either section.

Rare in the carboniferous limestone of Derbyshire.

(Col. University of Cambridge.)

Sarcinula Phillipsii (M'Coy).

Ref. ? Phil. Pal. Foss. fig. 15 D.

I have given the above name provisionally to a coral which I believe to be identical with the Flintshire one figured as above by Prof. Phillips, but not named or described. It is closely allied to the preceding species, but is of a thicker growth, the tubes are one-third larger and surrounded by thirty-two to forty strong radiating lamellæ extending to the adjoining tubes, and there is an obvious tendency in the middle of the transverse diaphragms to extend upwards to form an irregularly compressed solid axis, often visible in the weathered cups.

Common in the carboniferous limestone of Corwen.

(Col. University of Cambridge.)

Astræa carbonaria (M'Coy).

Sp. Char. Corallum forming very large masses, terminal stars from 9 lines to an inch and a half in diameter, obscurely pentagonal, bounded by narrow, rounded, cellular spaces (no simple divisional walls), having from 107 to 130 thin, jagged, radiating lamellæ, which descend to form an oval or circular cup, and one half of which rise again to form a large oval central boss, in the centre of which the lamellæ become indistinctly blended: *vertical section* shows the uninterrupted passage of the loose vesicular tissue, in gentle curves, from star to star; a very small space directly under the centre of each star having the vesicular structure almost transverse: *horizontal section* shows the alternately long and short radiating lamellæ connected throughout by fine transverse vesicular plates, and the former obscurely blended at the centre (no axis), and the irregular cellular structure intervening between the adjacent stars.

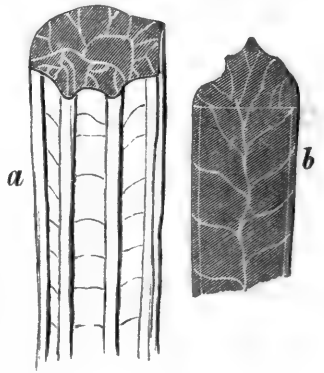
This magnificent species is the only true *Astræa* I have yet seen from the palæozoic rocks, the numerous corals of this age described under this generic title by British and foreign authors belonging for the most part to the family *Cyathophyllidæ*, often transversely septate in the middle and having solid polygonal divisional walls to the stars—characters completely at variance with those of the recent and mesozoic *Astræa*, and indicating important differences in the animals and mode of increase.

Abundant in some parts of the carboniferous limestone near Bakewell, Derbyshire; more rare in the same formation at Corwen.

(Col. University of Cambridge.)

Heterophyllia (M'Coy), n. g.

Gen. Char. Stem elongate, subcylindrical, irregularly fluted longitudinally: *horizontal section*, few, distant lamellæ destitute of any order of arrangement, but irregularly branching and coalescing in their passage from the thin solid external walls towards some indefinite point near the centre, where the few main lamellæ irregularly anastomose: *vertical section* showing about the middle an irregularly flexuous line (the edge of one or two of the radiating vertical lamellæ), from which on each side a row of thin, distant, sigmoidally curved plates extends obliquely upwards and outwards, forming a row of large rhomboidal cells on each side.



Heterophyllia: a. exterior of stem; b. horizontal and vertical section.

The paradoxical characters of the lamellæ—their perfect want of symmetry of disposition, and their irregular branch-like union among themselves, together with the remarkable openness of the cellular structure, render those corals totally unlike any other recent or fossil group. From *Cladocora* and *Caryophyllia*, to which they are most allied, they are distinguished by the want of the cellular axis, and by their few, unsymmetrical and anastomosing lamellæ. I suspect the *Cladocora? sulcata* of Lonsdale may belong to this group, but I have not seen examples of it myself.

Heterophyllia grandis (M'Coy).

Sp. Char. Stem slightly flexuous, about 5 lines in diameter, scarcely tapering in 3 inches, longitudinally marked with deep unequal grooves, and few, large, polygonal, unequal ridges,

giving a very irregularly angulose section to the stem ; surface smooth ; internal structure as given in the generic character.

Rare in the carboniferous limestone of Derbyshire.
(Col. University of Cambridge.)

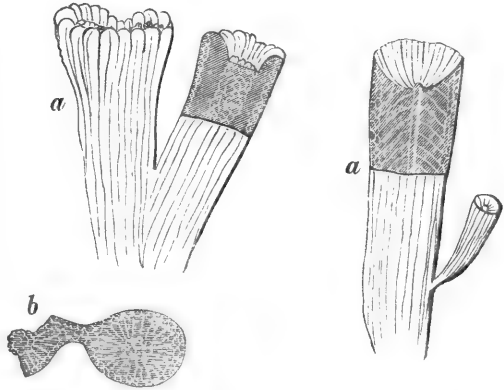
Heterophyllia ornata (M'Coy).

Sp. Char. Stems subcylindrical, long, flexuous, averaging $1\frac{1}{2}$ line in diameter, with about sixteen narrow, subequal, longitudinal ridges sharply defined, and separated by flat spaces rather wider than the ridges they separate, the ridges are set with small round tubercles more than their own diameter apart ; surface very minutely granulose : internal structure as in generic character ; *horizontal section*, lamellæ about fourteen at the margin.

Rather rare in the carboniferous limestone of Derbyshire.
(Col. University of Cambridge.)

Siphonodendron (M'Coy), n. g.

Gen. Char. Corallum of variously aggregated, branching, cylindrical or elongate-conic stems ; young branches produced by lateral buds ; outer wall thin, lined by two or three rows of small vesicular plates forming a narrow outer vesicular area in both sections ; terminal cups deep, lined by numerous vertical lamellæ, alternately larger and smaller, and having in the bottom a small, prominent, tubular axis : *vertical section* shows a



small, central, persistent, siphon-like tube or axis, which pierces through a series of long, conical or dome-shaped

Recent *Lithodendron*.
a. Mode of growth and vertical section.
b. Horizontal section.

Siphonodendron.
a. Mode of growth and vertical section.

transverse diaphragms occupying the greater part of the width of the tube, the convexity upward, forming in this section lines diverging downwards and outwards from the axis, till they reach the narrow external cellulose layer on each side : *horizontal section* shows the small tube-like axis, surrounded usually by a few thin concentric lines which are the edges of the conoidal diaphragms cut through by the section ;

from these the vertical lamellæ radiate to the circumference, where they are connected by the small transverse vesicular plates forming the narrow external cellular zone.

I propose this genus for a number of corals exceedingly abundant in the mountain limestone, but hitherto classed by Prof. Phillips, Mr. Lonsdale, and others with *Lithodendron*. This latter genus was originally proposed by Schweigger (Beobachtungen, &c. tab. 6) to include, 1st, the *Oculina* of Lamarck, including the type of Blainville's *Dendrophyllia*; and 2ndly, a division, which allowing the previously constituted genus *Oculina* to stand for the first division, becomes the real type of his genus, and the four references he gives to Esper's 'Pflanzen-thiere' as examples of this genus are typical examples of the group subsequently named *Lobophyllia* by Blainville; this latter name therefore becomes a mere synonym of *Lithodendron* and should be laid aside, unless, as many writers seem inclined, it be used for the short, wide species with lobed discs, and thus leave *Lithodendron* for the more slender cylindrical forms: although there is no clear line of separation between the groups, it may be convenient to retain both names for those extreme forms, but in no case can the *Siphonodendron* of the mountain limestone be brought in any close relation with those recent and mesozoic types. The differences are briefly these: 1st, *Siphonodendron* increases by lateral buds,—*Lithodendron* by a lateral elongation and gradual division of the old cup and dichotomous fissure of the stem; 2nd, *Siphonodendron* has a narrow tubular axis and wide conoidal diaphragms, while *Lithodendron* has a large cellular axis and no diaphragms. I have illustrated those points in the accompanying sketch. *Cladocora* of Ehrenberg agrees in external form and mode of branching with *Siphonodendron*, but has the internal structure here represented in *Lithodendron*.

Cladochonus brevicollis (M'Coy).

Sp. Char. Slender stem-like neck of each cell about 1 line long and half a line in diameter, the upper end suddenly swelling to a cup-shaped cell about 2 lines long and 1 line in diameter, curving downwards at an angle of about 135° , the point of junction of the cup and the stem giving origin, at an angle of 45° , to the stem of a second cell similar to the first, but inclining in the opposite direction, and in like manner giving origin from its upper convexity to a third and that to a fourth, &c. perfectly similar cell, forming together an erect, regularly zigzag corallum.

From its regularly angular mode of growth or connexion of the large drooping bell-shaped cups, inclining in opposite direc-

tions from thin short slender stems, this is one of the prettiest species of the genus. It most resembles the *C. tenuicollis* (M'Coy) figured in the 'Annals' for October 1847 (Pl. XI. fig. 8), from the carboniferous shales of New South Wales, but is distinguished by its smaller size and much shorter necks to the cells, while, as in that species, their small diameter compared with their cups distinguishes it from the *C. crassa* (M'Coy) of the carboniferous slate of Ireland.

Rare in the carboniferous limestone of Derbyshire.

(Col. University of Cambridge.)

(*Madreporacea*.)

Dendropora megastoma (M'Coy).

Sp. Char. Stem slightly flexuous, subquadrate, branches few, distant, resembling the main stem in size and shape, and coming off from it nearly at right angles; each face has a row of large oval cells with prominent edges, the sides of which have twelve vertical sulci ending in tubercles; the cells of each row are rather less than twice their diameter apart, the lateral rows opposite and alternating with the other two rows; the width of the cells slightly exceeds that of the face on which they rest, so as to indent the margin; interstices obscurely porospunctate; width of stem about half a line.

This beautiful coral is distinguished from the *D. explicita* (Mich.) from the Devonian beds of Boulogne-sur-Mer by its smaller size and larger cells. Michelin, in his 'Iconographie Zoophytologique,' founds this genus from the last-named coral, and approximates it to the genera *Criserpia* and *Aulopora*; the twelve sulci which I observe to the margin of the cells in this species however show that this cannot be the true affinity of the group, which must now rather be placed in the *Madreporacea* near *Seriatopora*.

I have examined several specimens on a piece of carboniferous limestone from Derbyshire.

(Col. University of Cambridge.)

Palæopora (M'Coy), n. g.

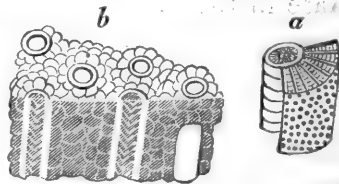
Gen. Char. Corallum polymorphous, generally subhemispherical and concentrically ridged beneath, rarely branched; formed of cylindrical, distinctly walled, tubular cells, having internally twelve vertical sulci or rudimentary lamellæ, and divided at irregular intervals by transverse diaphragms; the tubes surrounded and connected by a uniform minute network of small vesicular plates.

I propose this genus for all the so-called *Porites* of the palæozoic rocks. First described by Goldfuss as *Astræa*, they were re-

moved by Ehrenberg (Ueber Corallenthiere des rothen Meeres, &c.) and Lonsdale (Silurian System) to the recent genus *Porites*, in which they were followed—probably without examination—by many writers; Profs. Bronn (Lethæa, &c.), Phillips (Palæozoic Fossils) and others have however much more happily pointed out their resemblance to *Heliopora*. The distinct walled tubular cells visible in both sections, connected by cellular tissue, with their twelve rudimentary lamellæ, distinguish the present ancient corals from the modern genera just named, for *Porites* has a minutely reticulated corallum impressed by shallow polygonal *undefined* cells on the upper surface, and presenting in the horizontal and vertical sections an uninterrupted uniformly vesicular structure. *Heliopora* agrees perfectly in external appearance, and in the two sections exhibits the same characters of vesicular structure connecting tubular cells with transverse diaphragms, but in it the tubes have eighteen or more rudimentary lamellæ, while they are constantly twelve in the present genus, which I only know as yet in the older and middle palæozoic rocks.

Fistulipora (M'Coy), n. g.

Gen. Char. Corallum incrusting, composed of long, simple, cylindrical, thick-walled tubes, the mouths of which open as simple equal circular cells on the surface, and having transverse funnel-shaped diaphragms at variable distances; interval between the tubes occupied by a cellular network of small vesicular plates.



Fistulipora : a. mode of growth, nat. size, enveloping a crinoid stem.
b. magnified surface and section.

This genus is proposed to include the *Manon cribrosum* (Gold.) of the Eifel, &c., and the two following species from the mountain limestone. They have no affinity with the fossil sponges of the genus *Manon*, with which the only previously known species was classed by Goldfuss and others, but are more allied to the so-called *Porites* of the palæozoic rocks (*Palæopora*, M'Coy), from which they differ in the absence of the rudimentary radiating or vertical lamellæ to the cell-tubes. The sides of the tubes do not seem to be ever perforated by connecting pores.

Fistulipora minor (M'Coy).

Sp. Char. Cell-tubes with slightly prominent margins at the surface, about four in the space of one line, rather less than their own diameter apart, the intervening space composed of from one to three rows of the minute vesicular cells.

The tubes of this species are of so small a diameter that I have

not been able to see the diaphragms ; they are from half a line to nearly an inch in length according to the age of the example, but not altering materially their diameter or relative distance. It most usually occurs incrusting crinoid stems or other foreign bodies, from which the tubes radiate to the surface, and I suspect the whole corallum, from the minuteness of its parts, may have been taken for a *Favosites* or *Alveolites*, from which the lens will easily distinguish it by showing the reticulated interstices between the tubes.

Not uncommon in the carboniferous limestone of Derbyshire.
(Col. University of Cambridge.)

Fistulipora major (M'Coy).

Sp. Char. Cell-tubes two-thirds of a line in diameter and about their own diameter apart, their walls thick, of concentric layers, with closely placed funnel-shaped internal diaphragms : interstices minutely vesicular, four to six rows of vesicular cells between each pair of tubes.

The comparatively great size and distinctness of the parts of this coral enabled me first clearly to ascertain the generic peculiarities of the whole group.

Rare in the carboniferous limestone of Derbyshire.
(Col. University of Cambridge.)

FORAMINIFERA.

I believe no examples of this group have been hitherto determined in the British carboniferous rocks, which is the more remarkable from their great abundance in the corresponding deposits in Russia, and according to M. de Verneuil* in America. I may mention, that since the publication of M. Ehrenberg's paper on the carboniferous *Foraminifera* in the 'Monats Bericht' of the Berlin Academy, I have diligently sought for the several carboniferous species he describes in the limestone of a great number of different British localities without success. The following is the only species I have met with, and I only know it at present from the one locality.

Nodosaria fusulinaformis (M'Coy).

Sp. Char. Shell of two or more inflated, pyriform, easily separable lodges, the first one having a small mucronate point at its posterior end, and contracted to a very slender, short neck at the anterior end, which joins the pyriform second cell, which

* "Note sur le parallélisme des dépôts paléozoïques de l'Amérique Septentrionale avec ceux de l'Europe," &c., Bulletin de la Soc. Géol. de France, 2^e série, vol. iv.

is also contracted to a similar minute neck in front; surface smooth. Length of individual cells averaging 1 line, width two-thirds of a line.

So like is this in size and shape to the inflated variety of Fischer de Waldheim's *Fusulina cylindrica* occurring in such quantities in some parts of the Russian carboniferous limestone, that it might easily be mistaken for it; it is destitute however of the longitudinal external fissure-like opening and complex internal structure of that genus, seeming more properly allied to certain moniliform, few-celled *Nodosariae*, such for instance as the *N. rudis* and *N. rugosa* of M. D'Orbigny's work on the Austrian Foraminifera, with both of which species it agrees almost perfectly. The lodges or cells are almost always found separated (from the minuteness of the connecting neck), which gives them the striking resemblance to *Fusulinae* above alluded to; I have *heard* however of several of them having been found united in a line by their little necks, and I have myself seen two thus united, and the posterior cell not being a terminal one.

Occurs in great numbers on the weathered surfaces of the carboniferous limestone in the parish of Shivey, Tyrone, in the north of Ireland.

(Col. University of Cambridge and Royal Dublin Society.)

Exclusive of the above species, the following is a list of such British corals of the carboniferous period as I have myself noted since the publication of Morris's Catalogue of British Fossils in addition to the species there given; it includes, 1st, some species described by foreign authors which I have recognized in Britain; 2nd, a few Devonian species for which I give undoubted carboniferous localities; and 3rd, those new forms which I have figured and described in the 'Synopsis of the Characters of the Carboniferous Limestone Fossils of Ireland' published some years ago, the result of an examination of the collections made in that country by Mr. Griffith of Dublin, with whose permission I now however, for the first time, publish the principal geological and geographical localities, the omission of which in the work mentioned has often been regretted. All the localities except those in *italics* are in Ireland. All the species in *italics* are in the Geological Museum of the University of Cambridge. The following abbreviations are used of the rocks: *Ar. L.* Arenaceous Limestone, a peculiar band in the middle of the yellow sandstone at the base of the carboniferous series; *Calp.* a provincial term for a band of dark argillaceous limestone occurring between the great lower and upper limestones, accompanied in the north of Ireland by thick

beds of shale and a little sandstone; *C. L.* Carboniferous Limestone generally; *C. Sh.* Carboniferous Shale generally; *C. Sl.* Carboniferous Slate, the shales between the base of the lower limestone and the top of the yellow sandstone, alternating more or less with each at the points of junction; *L. L.* Lower Limestone, the great limestone of Ireland, between the Calp and the carb. slate; *U. L.* Upper Limestone, a thinner deposit than the lower limestone, occurring between the Calp and the millstone grit. *Y. S.* Yellow Sandstone—a thick sandstone at the base of the carboniferous system in Ireland, occupying the space between the carboniferous slate and the old red sandstone, and by many geologists considered to belong to the latter; I have recognised however in the shales intercalated with it nearly the same suite of fossils which we find in the carboniferous slate and in the Calp, and in the beds of arenaceous limestone occasionally occurring in it I have identified the most characteristic fossils of the main or lower limestone, so that no doubt remains in my mind of the correctness of Mr. Griffith's original view, that this sandstone forms the true base of the carboniferous limestone formation.

ALVEOLITES.

Goldfussi (Michel. sp.), Icon. Zooph. L. L. Hook Head, Wexford.
? palmata (M'Coy). *Flustra* id., Syn. Carb. Foss. Irel.
 Calp. Manor Hamilton.

ASTREOPORA.

antiqua (M'Coy), Syn. Carb. Foss. Irel. C. Sl. Hook Point.

AULOPORA*.

campanulata (M'Coy), Syn. Carb. Foss. C. Sl. Hook Head.
gigas (M'Coy), Syn. Carb. Foss. of Irel. Calp. Ballintrillick.
serpens (Gold.), Petrefacten. Calp. Bundoran.

BERENICEA?

megastoma (M'Coy), Syn. Carb. Foss. C. Sl. Hook Head.

CANINIA.

cornu-bovis (Mich.), Icon. Zooph. C. L. Corwen.
cornu-copiæ (Mich.), Icon. Zooph. C. Sh. Red Castle, Mt. Rath;
 Glasgow; I. of Man.
flexuosa (Gold. sp.), Petrefacten. C. L. Kendal.
gigantea (Mich.), Icon. Zooph. { C. L. Easky, Sligo.
 { C. Sh. Castletown Bay, I. of Man.
patula (Mich.), Icon. Zooph. C. Sl. Hook, Wexford.

* If the small recent and newer fossil corals referred to the genus *Alecto* really belong (as seems the general opinion now) to the *Polyzoa*, there could be no hesitation in considering the comparatively gross palæozoic species not only as generically distinct, but as belonging to a different order—the sulcation visible within the tubes of several of the species clearly indicating rudimentary radiating lamellæ, which, as they exceed twelve in number, place those corals among the *Anthozoa*,—most probably, I think, near *Syringopora*, in which a similar sulcation has been detected. Instead therefore of considering the words *Alecto* and *Aulopora* as synonymous, we may, with advantage, retain each for the peculiar section of the group indicated.

CAUNOPORA.	
placenta (Phil.), Pal. Foss.	C. Sl. Poulscadden Bay, Howth.
CERIOFORA.	
<i>affinis</i> (Gold.), Petrefacten.	C. Sh. <i>I. of Man</i> .
CLADOCHONUS.	
<i>antiquus</i> (M'Coy), Syn. Carb. Foss.	C. Sh. Rahan's Bay; St. John's Point, Donegal.
<i>bacularius</i> (M'Coy), Syn. Carb. Foss.	C. L. <i>Derbyshire</i> .
<i>crassus</i> (M'Coy), Syn. Carb. Foss.	{ C. L. <i>Derbyshire</i> . C. Sh. Lisnapaste; Lackagh.
CYATHAXONIA.	
<i>cornu</i> (Mich.), Icon. Zooph.	C. L. <i>Kendal</i> .
<i>spinosa</i> (Kon. sp.), Anim. Foss. Belg.	C. L. <i>I. of Man</i> .
DICTYOPHYLLIA.	
<i>antiqua</i> * (M'Coy), Syn. Carb. Foss.	C. Sl. Hook.
FAVOSITES.	
<i>Gothlandica</i> † (Gold.), Petrefacten.	C. L. <i>Derbyshire</i> ; <i>I. of Man</i> .
<i>inflata</i> (Kon.), Anim. Foss. Belg.	C. L. <i>Kendal</i> .
FENESTELLA.	
<i>antiqua</i> (Lonsd. Devonian var.), Geol. Trans. vol. v.	{ Y. S. Bruckless. C. Sl. Blackball Head, Cork; Currans; Clonea; Clonmel, &c.
<i>carinata</i> (M'Coy), Syn. Carb. Foss.	{ C. L. <i>Derbyshire</i> ; <i>I. of Man</i> ; Tynan; Mountmellick. Calp. Malahide.
<i>crassa</i> (M'Coy), Syn. Carb. Foss.	L. L. Ballynacourty; Kildare.
<i>ejuncida</i> (M'Coy), Syn. Carb. Foss.	L. L. Cork.
<i>formosa</i> (M'Coy), Syn. Carb. Foss.	{ C. L. <i>Derbyshire</i> . Calp. Malahide, Dublin.
<i>frutex</i> (M'Coy), Syn. Carb. Foss.	U. L. Killymeal, Dungannon.
<i>hemisphærica</i> (M'Coy), Syn. Carb. Foss.	U. L. Killymeal, Dungannon.
<i>Morrisii</i> (M'Coy), Syn. Carb. Foss.	L. L. Cork.
<i>multiplorata</i> (M'Coy), Syn. Carb. Foss.	{ C. L. Cork; Killymeal. Calp. Ballintrillick.
<i>oculata</i> (M'Coy), Syn. Carb. Foss.	C. Sl. Ballynacourty, Dungarvan.
<i>plebeia</i> (M'Coy), Syn. Carb. Foss.	{ C. Sl. Poulscadden. L. L. Cork; Howth; <i>Derbysh</i> . Calp. Bundoran; Ballintrillick.
<i>quadridecimalis</i> (M'Coy), Syn. Carb. Foss.	U. L. Black Lion, Enniskillen.
<i>varicosa</i> (M'Coy), Syn. Carb. Foss.	U. L. Black Lion, Enniskillen.

* More lately figured by Michelin (Icon. Zooph.) under the name of *Michelinea compressa*.

† It is several years since I first published this as a carboniferous coral from a single Irish specimen, concerning the locality of which some doubt was expressed. I have now examined a large suite from the Derbyshire limestone, and compared them minutely with authentic specimens of Goldfuss's coral from the Eifel, and am enabled fully to confirm my original observation.

GLAUCONOME.

- bipinnata* (Phil. var.), Pal. Foss. { C. Sl. Ballynacourty; Poulscadden.
Calp. Bundoran.
U. L. Killymeal, Dungannon.
- gracilis* (M'Coy), Syn. Carb. Foss. { C. Sl. Ballynacourty, Red Castle, Mt. Rath.
Calp. Ballintrillick.
U. L. Killymeal, Dungannon.
- grandis* (M'Coy), Syn. Carb. Foss. L. L. Meelick Chapel, Co. Clare.
- pulcherrima* (M'Coy), Syn. Carb. Foss. C. Sl. Hook Head.

GORGONIA?

- Lonsdaliana* (M'Coy), Syn. Carb. Foss. C. L. Laracor, Trim.
- ziezac* (M'Coy), Syn. Carb. Foss. Ar. L. Granard.

HEMITRYPA.

- Hibernica* (Sc. sp.), M'Coy, Syn. Carb. Foss. { L. L. Cork.
Calp. Ballintrillick.
U. L. Knockninny; Black Lion.

ICHTHYORACHIS.

- Newenhami* (M'Coy), Syn. Carb. Foss. C. L. Meelick Chapel, co. Clare.

MILLEPORA?

- gracilis* (Phil.), Pal. Foss. C. Sl. Ballynacourty; Lisnapaste.
- similis* (Phil.), Pal. Foss. C. Sl. Toberyellathan, Gort; St. Doolaghs, Dublin.

NEMAPHYLLUM.

- arana* (M'Coy). *Astræa* id., Syn. Carb. Foss. C. L. Magheramore, Tobercurry.

PETRAIA.

- bina* (Lonsd. Devon. var.), Phil. Pal. Foss. { Y. S. Bruckless.
C. Sl. Currens, Tralee.
- celtica* (Lamx. sp.), Phil. Pal. Foss. C. Sl. Clonea; Knocklofty.
- pauciradialis* (Phil. sp.), Pal. Foss. C. Sl. Currens; Ballynacourty.
- pluriradialis* (Phil. sp.), Pal. Foss. C. Sl. Currens, Castle Island.

POLYPORA.

- dendroides* (M'Coy). { Ar. L. Townparks, Killeshandra.
C. Sl. Red Castle, Mt. Rath.
- fastuosa* (Kon. sp.), Anim. Foss. Belg. { L. L. Hook Head.
U. L. Killymeal.
- marginata* (M'Coy), Syn. Carb. Foss. U. L. Killymeal, Dungannon.
- papillata* (M'Coy), Syn. Carb. Foss. { Ar. L. Townparks, Killeshandra.
L. L. Rathgillen, Nobber.
U. L. Black Lion, Enniskillen.
- verrucosa* (M'Coy), Syn. Carb. Foss. { C. L. Derbyshire.
C. Sh. Red Castle, Mt. Rath.

PTILOPORA.

- pluma* (Sc. MSS.), M'Coy, Syn. Carb. Foss. { C. Sl. Poulscadden, Howth; Hook.
L. L. Kildare.
Calp. Malahide.

RETEPORA.

- undata* (M'Coy), Syn. Carb. Foss. L. L. Kildare.

SIPHONODENDRON.

- pauciradiale* (M'Coy). *Lithodendron* id., Syn. Carb. Foss. C. L. Magheramore, Tobercurry.

STENOPORA.

scabra (Rafin. sp.). *Favosites* id., Kon. Anim. Foss. Belg.
C. Sl. Hook; Clonea; Currans.

STROMBODES (*Lithostrotion*, Lonsd.).

emarciatum (Lonsd. sp.), Geol. Russ. and Ural. C. L. *Derbyshire*.

VINCULARIA.

<i>dichotoma</i> (M'Coy), Syn. Carb. Foss.	{ L. L. Howth; Kildare.
<i>megastoma</i> (M'Coy), Syn. Carb. Foss.	{ U. L. Black Lion, Enniskillen.
<i>raricostata</i> (M'Coy), Syn. Carb. Foss.	U. L. Killymeal.
	U. L. Killymeal, Dungannon.

XIV.—*Supplementary Notices regarding the Dodo and its Kindred.*

Nos. 1, 2, 3. By H. E. STRICKLAND, M.A., F.G.S.

ONE of the main objects which Dr. Melville and myself had in view, in publishing our recent work on the *Dodo* and its Kindred, was to draw the attention of others to this interesting historico-physical investigation, and thus to elicit from all quarters such additional items of information as had escaped our own research. Many a curious scrap of *Dodo*-knowledge is doubtless still buried in the holes and corners of libraries, museums, and picture-galleries, and many a precious bone-fragment still moulders in the caverns and alluvions of the Mascarene Islands. Already, in the short interval since our publication saw the light, have several important links been added to the chain of evidence there displayed,—partly through the kind diligence of our friends, and partly by our own more recent researches. These supplementary facts I propose to communicate from time to time to the ‘Annals of Natural History.’

1. *Historical evidence of the Dodo*.—I grieve to be obliged to record that Oxford, the cradle of so much learning, now stands convicted of having been the grave, not of *one* *Dodo* (as was hitherto supposed), but of two. A small dingy MS. volume has lately been purchased by the fellows of Queen’s College, Oxford (I dare not say at what price), from Mr. Rodd the bookseller. This precious but unattractive little book is the original autograph diary of Thomas Crossfield, once fellow of Queen’s, and extends over fourteen years, from 1626 to 1640. Amidst a variety of matters, some of historical interest, and others “of no importance to any but the owner,” we find the following curious passage, which was first detected, and kindly communicated to me, by the Rev. Dr. Bliss.

Page 68. “1634. Spectacula Oxonii in hoc anno.

1. The Palsgraves Family.
2. His mat^{ties} Hokus Pokus.
3. Dancing vpon the rope.
4. Hierusalem in its glory, destruction.

The story deuided into 5 or 6 parts, invented by Mr. Gosling, sometimes schollar to Mr. Camden, engineer, who BESTOWED THE DODAR (A BLACKE INDIAN BIRD) VPON YE ANATOMY SCHOOLE. His wife dying left him some meanes in a chest, w^{ch} a maide seruant cunningly getting y^e key of her master, conveyed away, and soe he now glad to get his liuinge by vseing his wits for such inventions."

How Mr. Gosling obtained his "Dodar," or what subsequently became of it, we have not a particle of evidence. The contents, and even the locality, of "y^e Anatomy schoole" of 1634 are alike unknown, the existing Anatomy school having been founded about 1750, independently of any previous establishment. One thing is certain, that this "Dodar" was not the same individual as the one which subsequently formed one of the treasures of the Ashmolean Museum, which was "ordered to be removed" in 1755, and whose head and foot are fortunately still in existence. For we have the clearest evidence that the latter specimen was in Tradescant's private collection at Lambeth in 1656, and was not transferred to Oxford till 1683 (see 'The Dodo and its Kindred,' pp. 23, 32). Two Dodos have therefore existed, at successive periods, in the venerable repositories of Oxford University, where the naturalist from the remotest parts of Europe now makes the mouldering relics of one an object of pilgrimage.

I may here mention, that the preservation of these relics is due not so much to Fortune as to old Ashmole himself. In his original regulations for the management of his museum, it is enacted that when any of the specimens were found to be in bad condition, they should not be wholly destroyed, but the hard parts, such as the heads and feet, should be put away in a closet; and to this judicious proviso of the old astrologer we are probably indebted for the most important evidences now existing on the structure of the Dodo.

2. *Affinities of the Dodo*.—I have received from that excellent osteologist, Mr. Thomas Allis of York, the following interesting communication, relating to a point in the anatomy of the Dodo which Dr. Melville and I had overlooked, but which wholly confirms our conclusions.

"On looking at plate ix* I immediately perceived strikingly confirmatory evidence of your views as to the Columbidine affinities of the Dodo, unnoticed either by thyself or by thy talented coadjutor, in his elaborate anatomical description of the head of that bird. This evidence consists in the number of the sclerotic plates. At the Zoological Section of the British Association at Liverpool I exhibited dissections of the sclerotic ring of about seventy birds; among the seventy there were three species of

Columbidæ; each of these three had *eleven* plates in the sclerotic ring; being the precise number figured in the Dodo. No other bird had a similar number, and none so small a number, with the single exception of the Australian *Podargus*, in which bird the sclerotic ring is composed of one single bone, without the smallest trace of a division into separate plates. No abstract of my paper on the subject was published in the proceedings of that meeting, and its contents were never made public.

"I exhibited the rings of eight species of *Raptores*; the smallest number of sclerotic bones in this order was *fourteen*; and seven species of *Gallinidæ*, *thirteen* being the smallest number of plates.

"I thought this confirmatory evidence of the correctness of your views could not be otherwise than acceptable to thee; if thou considerest it of sufficient importance to deserve to be made known through one of our scientific periodicals, be so good as to get it inserted.

"Thy sincere friend,

"THOMAS ALLIS."

Let me here, in passing, express an earnest hope that some means may be found of giving to the public the benefit of the valuable and original researches of Mr. Allis, which have hitherto been retained in MS. by that "great difficulty" of natural-history-authors, the expense of illustrative engravings.

3. *Historical evidences of the Solitaire*.—In a recent exploration of the precious collection of foreign periodicals in the Bodleian library, I discovered a work of which I had long been in quest, the 'Mémoires de la Société Royale des Sciences et Belles Lettres de Nancy,' 4 vols. 12°, Nancy, 1754–1759. The President of the Society, M. d'Heguerty, had been governor of Bourbon about 1734, and in a discourse which he delivered March 26, 1751, he entertained the Nancy *savans* with an account of the Mascarene Islands. Speaking of Bourbon, he mentions pintados, partridges, and other birds, but says nothing of the brevipennate birds of that island, though we have proof that they still existed in the time of La Bourdonnaye, d'Heguerty's successor (see 'Dodo and its Kindred,' p. 60). He atones however for this omission by the following interesting notice of the Solitaire of Rodriguez, which is the more valuable as our previous historical evidence of that bird was almost wholly confined to the single testimony of Leguat. We now find that this bird survived from the time of Leguat's visit, 1693, down to about 1735, and that, like the Dodo, it was capable of being kept alive in confinement.

At vol. i. p. 79, M. d'Heguerty says, speaking of Rodriguez :

“On y trouve aussi des oiseaux de différentes espèces, que l'on prend souvent à la course, et entre autres des Solitaires, qui n'ont presque point de plumes aux ailes; cet oiseau, plus gros qu'un Cygne, a la physionomie triste; apprivoisé on le voit toujours marcher à la même ligne, tant qu'il a d'espace, et retrograder de même sans s'en écarter. Lorsqu'on en fait l'ouverture, on y trouve ordinairement des Béoards, dont on fait cas, et qui sont utiles dans la médecine.”

XV.—*Reply to Sir Philip Egerton's Letter on the Tail of Diplopterus.* By FREDERICK M'COY, M.G.S. & N.H.S.D. &c.

To the Editors of the Annals of Natural History.

GENTLEMEN,

Cambridge, Jan. 13th, 1849.

SIR PHILIP EGERTON has written a letter in your last Number, from which it would appear that I had acted unfairly towards Prof. Agassiz in my description of the diphycercal type of tail in the November Number of your Journal, by remarking that Agassiz called the tail of *Diplopterus* 'heterocercal,' and leaving it to be inferred that the ordinary heterocercal form was intended. Sir P. Egerton does not deny the accuracy of my description and figure of the tail of this genus and its difference from the true heterocercal type; and though no one comparing them with Agassiz's work will see any resemblance, yet Sir Philip Egerton endeavours to show that Agassiz gave the same characters that I do, by suppressing in his letter all allusions to those passages in Agassiz's writings which state without reserve that the genus was heterocercal, and by quoting a certain passage (giving a very imperfect notion of the tail however) in which the existence of rays above the spine is mentioned. I will not ask why Sir Philip Egerton only gave you the quotation from Agassiz's work as far as he did? or why he did not quote it entire? But I supply the missing line of the quotation: “La caudale est tronquée presque verticalement, et la colonne vertébrale finit à son angle supérieure;” and I may add to this (what Sir P. Egerton also omits to mention), that in the restored figure of the genus (tab. E), combining his latest information in the same work, Agassiz figures *Diplopterus* with a heterocercal tail perfectly identical with that of *Osteolepis* figured on the same plate, which is one of the most perfectly heterocercal fishes we know. This figure too is in accordance with the above omitted portion of the quotation, and with the prevailing theory that none but heterocercal-tailed fishes lived at those ancient periods; it shows that the quotation given by Sir P. Egerton did not imply a knowledge

on the part of Agassiz of the structure which I have pointed out in my paper; and it also shows the author's interpretation of what portion of rays are seen above the spine in fig. 1. pl. 18. of the Monog. of the Old Red Fishes, which Sir P. Egerton states to be a good representation of the structure (although he does not mention that fig. 2 of the same plate represents it as perfectly heterocercal). Will Sir Philip Egerton compare Agassiz's restored figure referred to, with mine in your Journal, and say that that is right and mine wrong? or will he say that his figure and the above portion of the quotation are not as clear definitions of the heterocercal type of tail as it is possible to give? I trust these observations will show, that whatever "unfairness" may be in this discussion is not on my side; and I may assure Sir Philip Egerton, that not for all the palæontological discoveries in the world would I misrepresent the writings of any one, much less of Prof. Agassiz, for whose brilliant talents, extensive learning, and enormous service to natural science, no one can have a more profound veneration than myself.

With regard to my "using the cancelled specific appellation *latus* when speaking of the *Coccosteus decipiens*," I must beg to refer Sir Philip Egerton to the Rules for Nomenclature published by the British Association for the Advancement of Science, for the reasons which have influenced me in retaining the original name.

I have the honour to remain, Gentlemen,

Your most obedient servant,

FREDERICK M'COY.

XVI.—*Reply to Prof. Owen's Letter on the Ganoine of some Fish-teeth.* By FREDERICK M'COY, M.G.S. & N.H.S.D. &c.

To the Editors of the Annals of Natural History.

GENTLEMEN,

Cambridge, Jan. 13th, 1849.

IN reference to Prof. Owen's letter in your last Number, will you favour me by the insertion of a few lines?

In your Number for August last, I published a notice of some fossil fish, and in describing the teeth used the new term "*ganoine*" to designate a peculiar modification of "*dentine*," which, from forming the hard polished surface of those teeth, had been confounded with true enamel by nearly all writers on fossil fish. To define the term, I briefly defined the tissue for which I used it, and its anatomical distinction from "*enamel*." Prof. Owen writes to point out that he had observed the distinction himself, as indeed every anatomist must who looks at a slice of tooth through a microscope; yet in the note to his letter he cites a

case from his 'Odontography,' where he had himself inadvertently called it "enamel" in describing a fossil tooth (*Petalodus*), although in other places he had described it as it is. Prof. Agassiz I believe in all his descriptive characters has called it "enamel," and so have most writers. The case therefore stands now as before, namely, that a peculiar modification of tissue exists in certain fish-teeth, very different from "enamel," yet confounded with it by many writers, frequently called "enamel" in the technical descriptions, and for which no other term had hitherto been proposed; my object now is to state, that in proposing the term "*ganoine*" for the sake of brevity and accuracy in the descriptions of the fossils I was engaged on, I by no means intended to impute ignorance of its structural peculiarities to any preceding writer. If I had been aware that Prof. Owen had used the word in question orally at his lectures for the polished part of ganoid scales, and that he would have preferred "*vitro-dentine*" for the dental tissue, I should of course have used it also; but as those terms have not been so published, while mine is already current, it is scarcely possible I think to make a change now without producing more confusion than the change would be worth.

I have the honour to remain, Gentlemen,

Your most obedient servant,

FREDERICK M'COY.

XVII.—*Contributions to the Botany of South America.*

By JOHN MIERS, Esq., F.R.S., F.L.S.

WITHERINGIA.

THE following observations will I hope serve to throw some light upon this hitherto obscure genus. It always appeared to me that the *Witheringia picta*, as figured by Martius (Nov. Gen. tab. 227), must either form the type of a very distinct group, or be considered as a very good illustration of that genus, for which reason I refrained from publishing what I had long ago observed on the subject, until I could satisfy myself of the absolute character obscurely indicated by L'Heritier, in regard to his typical species *W. solanacea* (Sert. Angl. 33. tab. 1). Under this uncertainty (in a note, Lond. Journ. Bot. iv. 353) I alluded to the unsuccessful search I had everywhere made for some specimen, or better details, of the plant in question, so as to be able to comprehend the limits and features of the generic character of *Witheringia*, and I expressed my regret that the original type no longer existed in L'Heritier's herbarium in the British Museum, as that would at once have cleared up this ambiguity. Dr.

Sendtner has since come to a more decided conclusion, by proposing Martius's plant before alluded to as the type of a new genus, which he calls *Athenæa*; but I am not aware upon what grounds he holds it distinct from *Witheringia*, nor can I learn that he has given any determined limits of this latter genus. From observations lately made, it appears to me that farther uncertainty on this point need not be entertained, and I propose therefore, to offer my reasons, founded on the facts now demonstrated, for justifying the conclusions thus formed. In Sir Wm. Hooker's most valuable herbarium there exists among Goudot's collection from Columbia, a plant which appeared to me to be a *Saracha*, except that its habit is rather more suffruticose and erect than most species of that genus, and its flowers smaller and fewer than usual: on examining this more attentively and comparing it carefully with the figure and description of L'Heritier's plant, I could not do otherwise than conclude that it was very closely related to his *Witheringia solanacea*, and as such may well serve, in the absence of the original, as a substitute for the type of what he intended as that genus. I have also compared this Columbian plant with the descriptions given by Prof. Kunth of several fruticose species, which he arranged in the same genus, and at the same time have examined several analogous plants from intertropical America, either closely allied or nearly identical with these last-mentioned species; and finally, I have compared these with the *Witheringia hirsuta*, Gardn., a species that does not seem to differ from the *W. picta*, Mart., collating this at the same time with Von Martius's excellent description and figure of this latter species before quoted: all these forms exhibit a gradation from *Saracha* on the one hand to *Acnistus* on the other. But *Witheringia*, according to modern authors, is made to embrace a number of heterogeneous species, and it is obvious that, without taking into account L'Heritier's plant, all the remaining species in the herbaceous section enumerated by Dr. Walpers (Repert. iv. 29) do not belong to that genus, being mostly referable to a very distinct section of *Solanum*, probably a good subgenus.

Throughout the vegetable kingdom we find individuals possessing aberrant characters, and exhibiting an intermediate state between the artificial limits of our botanical distributions, or partaking of their mutual extremes, and this is as fully apparent in the *Solanaceæ* as in any other family. Thus, many experienced botanists have found it difficult to determine whether certain individuals should be referred to *Petunia* or *Salpiglossis*, plants not only belonging to separate genera, but hitherto placed in distinct natural orders. In like manner it may be doubted whether certain plants should be referred to *Physalis*, when they are seen

to be scanty of the very remarkable character that distinguishes most of its species, viz. the remarkable growth and extreme inflation of the calyx in fruit; and so also in the approximate genus *Saracha*, individuals are sometimes observed, where, combined with a calyx not sensibly increasing in size, they present a corolla deeply campanulate, marked with large coloured spots, and a pentangular border so characteristic of *Physalis*: in these equivocal points of structure, it appears to me we may call in the aid of their general habit in order to determine the genus to which they should be referred, for in *Physalis* the inflorescence will be found to be universally 1-flowered in each axil, while in *Saracha* it is as uniformly more or less distinctly umbellate. Thus likewise in *Acnistus*, a genus with *Cestrum*-like flowers, we have a very variable length of the tube of the corolla, which in *A. umbellatus* is hardly distinguishable from the section *Chænesthes* of *Iochroma*; while in *A. arborescens* (the original *Cestrum cauliflorum* of Jacquin, Hort. Schoenb. tab. 325) the tube is so short as to leave no possible distinction between this genus and that called *Witheringia* by Kunth, as will be hereafter demonstrated.

Now, as will be hereafter shown, neither *Witheringia solanacea*, nor the Columbian plant here alluded to as being so closely allied to it, can be distinguished from *Saracha*; they have both a 5-partite calyx, a rotate corolla deeply cleft, stamens arising from triangular expansions originating at the base of its short tube, and the fruit is a pisiform berry supported on a calyx that does not materially increase in size; the peduncle is bifurcate, and forms a 2-flowered umbel as in many species of *Saracha*; and to make this analogy still more complete, although the stem is somewhat lignescent and perennial at base as in some species of this last-mentioned genus, their branches are in like manner herbaceous, and L'Heritier describes *Witheringia solanacea* as possessing the same kind of large tuberose root as in the *Saracha jaltomata*, Schlecht.: for all which reasons I have no hesitation in referring all these plants to one genus.

Of the fruticose species hitherto included in *Witheringia*, there are evidently two distinct groups, the several Columbian species enumerated by Kunth, and the Brazilian species of Martius: the former are distinguished by having extra-axillary fascicles, generally of numerous, sometimes of very few flowers, always upon simple peduncles, and not umbellate as in *Hebecladus*; the calyx is always distinctly tubular, with an almost entire margin, and five very minute distant teeth, not 5-partite as observed in *Hebecladus*, *Saracha*, and *Witheringia picta*; the corolla is tubular, with a 5-partite border, not so decidedly long and infundibuliform as in *Hebecladus* and *Acnistus*; the berry is small, seldom

exceeding the size of a peppercorn, and is supported on a small persistent and nonaugescent calyx ; it is not one-tenth the size of the large oval berry inclosed within its increasing calyx, which is seen in *Witheringia picta* ; the positive characters here alluded to will be found to approach very closely to *Acnistus*, and to be quite incompatible with the plants of the other group referred to.

From these several facts the inference is irresistible, that *Witheringia solanacea* should at once be referred to *Saracha*, and that *Witheringia macrophylla*, *W. ciliata*, *W. mollis*, *W. rhomboidea*, *W. dumetorum* and *W. riparia* of Prof. Kunth, together with some others, form a distinct group, which I propose to call *Brachistus*, and that the genus *Witheringia* as defined by L'Heritier must fall upon that group of plants, of which the *Witheringia picta*, Mart., may be considered the type. These are distinguished by an inflorescence either solitary or fasciculate in each axil or dichotomy of the branches, in which latter cases they arise successively at different periods, so that we see in each fascicle, every gradation of development from the nascent bud to the ripened fruit : the peduncle is always 1-flowered, slender and drooping in the young flower, but it grows much longer, becomes rigidly erect, and is considerably thickened towards the apex, in fruit : the calyx is 5-partite, the corolla has a very short tube, and a deeply 5-cleft rotate border, with the stamens arising from triangular extensions a little above the base of the tube, as in *Hebecladus* and *Saracha* : the berry is large, oval, and wholly included within the enlarged calyx, and the form of the embryo of its seed is spiral.

It may be urged that the name of *Saracha* should give place to that of *Witheringia*, but such a change would answer no good purpose, and could not be effected without great confusion, a very unnecessary creation of synonyms, and the annihilation of a genus long recognized. The recommendation above suggested appears to me the only proper course to pursue, and in adopting it, we do not violate the rule of priority, as L'Heritier's plant was only a cultivated specimen, the place of whose origin is still quite unknown ; and as no specimen of it appears to be in existence, it is clear that as a species, and especially as the type of a genus, it must ever remain problematical : and finally, that as L'Heritier's generic character remains in full force, as applied to another distinct group, the tribute intended by him to honour the memory of Withering is thus inviolably preserved. The genus *Witheringia* being thus established, it follows as a necessary consequence, that the *Athenæa* of Dr. Sendtner must give place to it. The following generic character drawn up from my own observations will not be found to differ materially from that of the author last mentioned.

WITHERINGIA, L'Her., Mart. *Athenæa*, Sendt.—*Calyx* subcampanulatus, profunde 5-partitus, persistens. *Corolla* rotata, tubo brevi, limbo 5-partito, laciniis oblongis, acuminatis, æstivatione valvata. *Stamina* 5, erecta; *filamenta* filiformia, brevia, paulo supra basin corollæ inserta, imo repente triangulariter dilatata, et hinc in annulum fere coalita; *antheræ* oblongæ, 2-loculares, basi emarginato-cordatæ, loculis connectivo angusto dorsali parallele connatis, longitudinaliter dehiscentibus. *Ovarium* ovatum, 2-loculare, ovulis plurimis, utrinque dissepimento adnatis. *Stylus* simplex, longitudine staminum, apice incrassatus, fistulosus. *Stigma* subintegrum, glandula glutinosa 2-loba semi-immersa. *Bacca* ovata, calyce aucto tecta. *Semina* compressa, rhomboideo-reniformia, in pulpam tenuem nidulantia, *testa* scrobiculata, subscabra, hilo perforato in sinu marginali. *Embryo* in *albumen* carnosum, subspiralis: *cotyledonibus* semiteretibus, *radicula* 3–4-plo brevioribus.—Frutices *Brasilienses*, *dichotome ramosæ*; folia *alterna*, vel *gemina altero minori* (in *turionibus subfasciculata*), *integra*; flores *pedunculati*, *axillares*, vel in *dichotomiis solitarii*, *bini*, vel *plures fasciculati*, et tunc *alterna vice singulatim tardius enati*, pedunculo fructifero demum erecto, elongato et incrassato.

1. *Witheringia picta*, Mart., *Nov. Gen. et Spec.* iii. 74. tab. 227. *Witheringia hirsuta*, *Gardn. Lond. Journ. Bot.* i. 541. *Athenæa picta*, *Sendtn. Flor. Bras.* fasc. vi. p. 134; *Walp. Repert.* vi. 580.—*Brasilia*, Prov. Rio de Janeiro et Minas Geraës.

To the long and excellent description of Von Martius above referred to, it is quite unnecessary to offer the smallest additional remark, except that Gardner's plant which I collected at the same time does not appear to me to offer any difference from that figured by Martius, and that it is a little more hairy*: if therefore it does not belong to this species, it most probably is referable to *W. pogogena*. Of the following seven species I have no knowledge whatever, beyond the short notice extracted by Dr. Walpers from Dr. Sendtner's description, to which I refer the reader.

2. *Witheringia pogogena*. *Athenæa pogogena*, *Sendtn. loc. cit.* p. 135; *Walp. Repert.* vi. 580. *Solanum pogogenum*, *Moricand, Pl. Nouv. d'Amér.* iii. 24. tab. 17.—*Brasilia*, Prov. Bahia.

3. *Witheringia micrantha*. *Athenæa micrantha*, *Sendtn. loc. cit.*; *Walp. Rep.* vi. 580.—*Brasilia*, Villa Vicsa.

* As Dr. von Martius's admirable work is within the reach of few persons, and as it may be desirable to compare the above with its analogous genera, I have given a figure with full details of the structure of this species, which I first collected at Tejuca in 1833, and afterwards with Mr. Gardner in 1837 (*Gardn. no. 237*); it will be shown in the 'Illust. S. Amer. Plants,' pl. 35.

4. *Witheringia Schottiana*. Athenæa Schottiana, *Sendtn. loc. cit.*; *Walp. Rep.* vi. 581.—Brasilia, Prov. Rio de Janeiro.
5. *Witheringia Pohliana*. Athenæa Pohliana, *Sendtn. loc. cit.*; *Walp. Rep.* vi. 581.—Brasilia, Prov. Minas Geraës.
6. *Witheringia Martiana*. Athenæa Martiana, *Sendtn. loc. cit.*; *Walp. Rep.* vi. 581. *Solanum paradoxum*, *Schott MSS.*—Brasilia, Prov. Rio de Janeiro et Minas Geraës.
7. *Witheringia hirsuta* (*non Gardn.*). Athenæa hirsuta, *Sendtn. loc. cit.*; *Walp. loc. cit.*—Brasilia, Prov. Minas Geraës.
8. *Witheringia anonacea*. Athenæa anonacea, *Sendtn. loc. cit.* tab. 18; *Walp. loc. cit.*—Brasilia australis.

BIBLIOGRAPHICAL NOTICES.

The Treasury of Natural History, or a Popular Dictionary of Animated Nature. By SAMUEL MAUNDER. London: Longman, Brown, Green, and Longmans.

MANY of our readers no doubt still retain some affection for *the* Natural History Book of their more youthful days. But, with whatever regard we may view this old friend and companion,—with its queer woodcuts—its lion, tiger, elephant, and *anonymous animal* thrown out in bold relief, while the beetle, the bug and the butterfly are summarily dismissed with a most magnanimous disregard of specific distinctions,—when we consider the great increase which has taken place in our stock of zoological knowledge since the days of Buffon and Goldsmith, and the number of otherwise well-informed persons with whom we are daily brought into contact, whose knowledge of Natural History is entirely derived from the study, in years long gone by, of the “History of Three Hundred Animals,” it can hardly be denied, that there has long been an absolute necessity for some cheap and decidedly popular work on the subject, which should give some knowledge of zoological classification to those who, from the want either of time or inclination, have never troubled themselves with the study of nature, and at the same time furnish them with a hand-book for reference, on any ordinary matters connected with the science. To supply this want is the object of the ‘Treasury of Natural History.’

It is questionable whether it be advisable to plunge the beginner, at the very outset of his career, into all the mysteries and technicalities of an exact system, and Mr. Maunder has perhaps judged rightly in preferring the alphabetical arrangement for the body of his work, to throwing his subject into a systematic form; for many will be induced to read portions of a book, when arranged in a manner with which they are familiar, who would be frightened at once on finding themselves encountered, at starting, by a classification of which they are totally ignorant. Moreover, the systematic table at the commencement of the work will be found quite sufficient to give the reader that general idea of classification which a beginner requires,

and to render easy the subsequent acquisition of a more exact knowledge of that portion of the subject. It follows, as nearly as possible, the arrangement given by Cuvier in the second edition of his '*Règne Animal*,' with alterations in those portions of it which have been modified by succeeding observers.

As the necessarily low price of a popular work must always impose a narrow limit on its author, it is evident that certain groups and species will be thrown more prominently forward than others. Mr. Maunder appears to have selected for this purpose those which are most likely to come immediately under the notice of the young naturalist, namely the British birds and butterflies, most of which are noticed in the work, and many of them nicely and accurately figured in the accompanying woodcuts. Eight hundred and sixty of these illustrations are scattered through the book, principally representing the species referred to in the letterpress, but occasionally furnishing the reader with illustrations of the anatomical and generic characters of the groups under discussion. "As to the manner in which this work has been embellished," says Mr. Maunder in his feeling and well-written preface, "I can speak with perfect satisfaction. About *nine hundred accurate woodcuts* have been given; and in order that this highly important part of the work should not be treated slightly or erroneously, I obtained the valuable assistance of Mr. Adam White, of the British Museum, a gentleman who to the enthusiasm belonging to the true naturalist unites a sober judgement and great experience. To him was accordingly entrusted the selection of all the subjects, and under his superintendence every drawing has been made by competent artists. And here let me add that I have availed myself of Mr. White's acknowledged zoological attainments, and improved my book by adopting many valuable hints and suggestions with which he has from time to time kindly furnished me. The engravings are in Mr. R. Branstone's best manner, and will no doubt be properly appreciated."

In the alphabetical portion, the animals are arranged principally in accordance with their English names, where such exist; but the scientific names are also given, thus furnishing the uninitiated reader with some insight into the mysteries of the binomial method of nomenclature, which, fortunately, still survives the attacks of French radicalism. Mr. Maunder however has wisely avoided encumbering himself with synonyms, and the one example (see *Asserador*) with which he has furnished his readers, of the synonymy of a species, will no doubt prove abundantly mystifying to those who are still happy enough to suppose that there is but one name for each animal, and one animal for each name.

We must not omit to notice the excellent "*Syllabus of Practical Taxidermy*" which will be found at the end of the '*Treasury*.' The preface states that it is by Mr. A. Hepburn of Whittingham, and it is one of the best treatises on the subject with which we are acquainted. It forms a very appropriate appendage to a work intended to raise a taste for Natural History in the minds of the young, and will prove very valuable to the country zoologist. A "*Glossary of Technical Terms*" closes the volume.

We regret that our space does not permit us to make any extracts from the book, but we can assure our readers that they will find in it a vast mass of useful information, compressed into a very small space and in a convenient form for reference. The most recent works, including voyages and travels, appear to have been consulted with advantage, and the extracts from them to have been well and carefully selected.

We hope that in some future edition Mr. Maunder will shorten such articles as that on Man, as the space might be much more advantageously occupied by other subjects.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

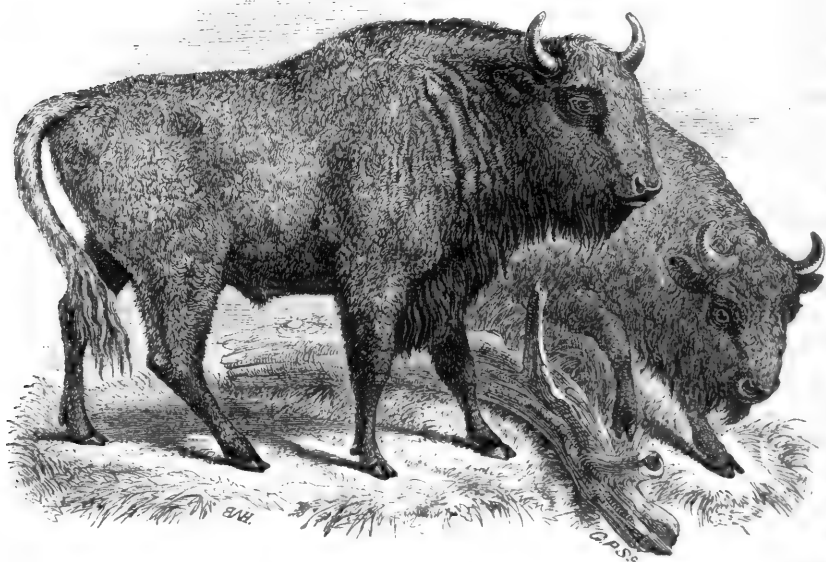
January 25, 1848.—Dr. Gamble in the Chair.

The following paper was read:—

NOTE ON THE CAPTURE OF THE AUROCHS (*Bos Urus*, Bodd). By M. DIMITRI DE DOLMATOFF, MASTER OF THE IMPERIAL FORESTS IN THE GOVERNMENT OF GRODNO.

(Communicated by Sir Roderick Murchison.)

Having been appointed, in 1842, Master of the Forests of the Government of Grodno, I have been led, as much by duty as by inclination, to pay particular attention to the forest of Bialowieza, the last asylum of the Bison of Europe, and I have given a description of that primitive forest and of its interesting inhabitant, both worthy to be numbered amongst those curiosities which our beautiful and im-



mense country presents. My work was favourably received by our government, but subsequently five years of assiduous observations and researches have convinced me that that work is incomplete, and have

excited in me the desire to draw up a treatise on the Bison ; for my own experience embraces curious facts and free from all error.

I have turned my attention particularly to refute by experience the erroneous opinion, accredited by all the writers who have treated on this subject, namely that the calf of the Bison cannot be suckled by our domestic cow. This fable has been repeated even in the work of an esteemed writer of our times, the Baron de Brinvers, who relying upon the recital of another writer, the learned Gilibert, asserts that two female Bison calves, caught in the forest of Bialowieza, seven weeks old, constantly refused the teats of a domestic cow ; that they consented, indeed, to suck a goat, but as soon as they had had enough, they repelled their nurse with disdain, and grew furious whenever they were put to a domestic cow. M. de Brinvers had not himself the possibility of verifying this fact ; and he cites traditions, communicated to him by the old inhabitants of the environs ; for if any one of the forest guards, or the peasants who inhabit the forest, had even met a Bison calf, parted by any accident from its mother, he would rather have left it, than seized and nursed it, in contravention of the severe law, which prohibits the capture or killing of a Bison. It was therefore only the supreme order of His Majesty the Emperor, emanating from the desire expressed by Her Majesty Queen Victoria to possess in her Zoological Garden two living Bisons, which has enabled me to rectify the error above mentioned. For as many attempts had already proved, that Bisons captured full-grown and in their wild state could never bear the captivity and especially the transport, and would infallibly perish, I proposed to catch two young calves, and to suckle them at the houses of the forest guards. His Excellence the Minister of the Domains of the Empire, Comte de Kisseleff, having approved of this project, and ordered it to be put in execution, I went without delay to the forest of Bialowieza. It was the 20th of July, 1846, at daybreak, and assisted by 300 beaters and 80 keepers of that forest, armed with fowling-pieces, charged only with powder, that we set out on the trace of a troop of Bisons explored during the night.

The day was superb and the sky serene ; there was not a breath of wind, and nothing interrupted the calm of nature, so imposing under the majestic dome of the primitive forest. . . . The 300 beaters, aided by 50 keepers, had surrounded in the most profound silence the solitary valley in which were the troop of Bisons. Accompanied by 30 keepers of determination and merit, we penetrated, step by step, into the surrounded enclosure, advancing with the greatest caution, and, so to speak, holding our breath. Arrived at the limit which bordered the valley, we enjoyed one of the most interesting pictures ! The troop of Bisons was lying down on the slope of a hill, ruminating, in the most perfect security, whilst the calves gamboled around the troop, amused themselves with attacking one another, striking the ground with their agile feet, and throwing up the sand into the air : then they ran off to their respective mothers, rubbed themselves against them, licked them, and then returned to their gambols. But at the first sound of the horn the picture changed in the twinkling of an eye ! The troop, as if struck by a magic wand,

jumped on their feet, and seemed to concentrate all their faculties in two senses, hearing and sight. The calves pressed timidly against their mothers. Then, when the noise of the hounds resounded, the Bisons hastened to range themselves in the order which they usually take in similar circumstances, namely, placing their calves in front they form the rear-guard, to protect them from the pursuit of the dogs, and advance. Arrived at the line occupied by the beaters and the keepers, they were received with piercing cries and firing of guns. They then changed the order of defence; the old Bisons rushed with fury on one side, broke the line of chase, and continued their course victoriously, bounding along, and disdaining to trouble themselves about their enemies who were crouching against the enormous trees. The keepers however succeeded in detaching two calves from the troop: one, aged 3 months, was taken at once; the other of 15 months, though seized by eight persons overthrew them and fled. The dogs were set in pursuit, and the Bison, forced into a marsh, was bound and carried to the court-yard of the forester. Four Bison calves, 1 male and 3 females, were taken in other places in the forest. One of these females, aged only a few days, was suckled at first by a domestic cow, of a fawn colour similar to that of the Bison, and, to the surprise of every one, the cow manifested a tender attachment for this adopted wild and bearded young one. Unfortunately the young animal died six days afterwards, suffocated by a swelling in the neck, which it had before it was caught, and which was continually increasing. The other calves took no food the first day of their captivity; but on the following day, the one aged 3 months began to suck a cow and seemed gay and lively. Its companions in captivity, excepting the one 15 months old, began at first to take milk from a man's hand, then they drank from a pail with great avidity, and when the pail was empty they licked one another's muzzles. In a short time they lost their wild look, and their timidity changed into an extreme vivacity and petulance. When let out of their stable, into the large court-yard of the farm, the rapidity of their movements, their agility, and the lightness of their leaps, similar to those of the goat or stag, astonished every one. They played with the calves of the domestic cows of their own accord, combated with them, and although stronger, they appeared to yield to them from generosity. The male Bison of 15 months for a long time preserved his wild and stern look; he was irritated at the approach of any one, shook his head, lashed his tail, and presented his horns. After two months of captivity he was at length tamed, and attached himself to the peasant who fed him; and then more liberty was given him. The Bisons are in general fond of striking the ground with their feet, throwing the earth into the air, and then rearing as horses do. They exhibit much attachment to the person who feeds and looks after them, come and rub themselves against him, licking his hands, and obeying his voice; they run bounding up when he calls them. Whenever they were let out of the stable, they grew animated, raised their head proudly, dilated their nostrils, snorted with force, and gave themselves up to all kinds of sports; but soon perceiving that

they were shut up, they turned their looks now toward the immense forest, then toward the carpet of verdure spread out before them in the distance; they seemed to recollect their wild liberty, and lowering their head they returned into their stable with an inexpressible sadness.

Six Bison calves, taken last year during the chase which I have just described, were brought up in two places, at some distance from one another. The two males caught during the first chase suffered nothing from the new food which was offered them; the others, which drank the milk instead of sucking it, had diarrhoea for a week. But it is probable that this complaint arose from the milk, with which they were fed, being brought from some distance, and becoming sour on the transport; for as soon as two cows were procured for each Bison, and they received fresh and lukewarm milk, the complaint ceased. The two first became accustomed also to lick salt, whilst the others never touched it. As for the young Bison, aged 15 months, he would not take milk, and began from the first day to eat oats mixed with chopped straw, hay from the forest and the meadows, the bark and leaves of the ash, the wild pear, the hornbeam, the aspen and other young shrubs. The same food served for the other young Bisons, when milk was no longer given them. They drink spring and river water indifferently, and take more and oftener in the day during the summer. The young calves refused at first to quench their thirst with pure water, and it was necessary to whiten the water with a little milk. Hunger and thirst make them utter a kind of grunt similar to that of the pig. Abundant and varied food, a stable which in winter protected them against the cold and in summer against insects, had a remarkable influence on the growth of the young Bison; so much so, that a young female, captured in January of this year, and intended to supply the place of one which died, was found to be only half as large as its companions of the same age taken last year and brought up by man's care. And as history tells us of bisons being killed of enormous size, and that in their wild state they are of different shapes, it would be interesting to ascertain what dimensions a Bison might attain, tamed, fed, and brought up by man; especially in England, where the art of rearing domestic animals is carried to the highest degree of perfection. Another still more important experiment would be to attempt to couple a Bison bull with a domestic cow; and I am led to think the thing possible from the inclination manifested by the young Bison bull taken last year, and now aged 2 years and 3 months, towards the female calf. Perhaps a new crossed race of cattle might thus be obtained, which, uniting extraordinary strength and agility with docility and attachment to man, might become of great utility to him. Lastly, taking into consideration that one pair of young tamed Bisons is destined for London, the second for St. Petersburg, and the third to remain here, on their natal soil, it would be no less interesting to communicate reciprocally and at proper times the comparative observations which shall have been made on the climatal influence exercised on these animals in the different regions whither they shall be transplanted.

The tamed Bisons carried from Bialowieza to Grodno have just made by land a journey of 140 versts (20 German leagues). The pair destined for St. Petersburg was shut up in an oblong cage, covered with straw, divided into two compartments, so that the Bisons could lie down without turning away from one another. This new prison and the jolting of the carriage had a painful effect on the spirit of the Bisons, and although tranquil and resigned, they took no food, and would not lie down for the first twenty-four hours; but the second day they became calm and returned to their old habits. The journey lasted three days.

The male and female destined for London travelled in a much more spacious and uncovered cage. The male was very restless during the whole journey, struggled incessantly, made a roaring similar to the bellowing of the bull, and wounded himself in the eye in attempting to leap over the bar of the cage, two toises high. Of the age now of 15 months, the male is 4 feet 1 inch in height and 5 feet 6 inches long; the female is 4 feet high, and 5 feet 3 inches long.

At Grodno the Bisons are placed in a spacious stable, and each pair is separated from the other. At first, on attempting to put them together, they fell to fighting desperately, so much so that they even knocked down the solid partition which separated them; they began by all attacking one another, and then, which is a singular fact, the three male Bisons fell upon the only female within their reach, and would infallibly have killed her, if the keepers had not defended her. Subsequently they became accustomed to one another, and the combats ceased.

It would be necessary, in my opinion, to keep the Bisons in a spacious park, where they would be able to live at their ease; and as they detest brilliant colours, and red especially enrages them, their keepers ought to wear clothes of a dark colour. I should also mention that they dislike dogs, and grow furious when pursued by them.

DIMITRI DE DOLMATOFF,

Master of the Forests of the Government of Grodno.

BOTANICAL SOCIETY OF EDINBURGH.

Jan. 11, 1849.—Professor Balfour, President, in the Chair.

The following communications were read:—

1. "A short Notice of Berwickshire Plants," by James Hardy, Esq. In this communication Mr. Hardy first alluded to the vegetation of the coast between Cockburnspath and the mouth of the Peaseburn; the chief plants of importance being *Glaucium luteum*, *Astragalus glycyphyllos*, *Blysmus rufus*, *Carex extensa* and *Ligusticum scoticum*. The oyster-plant (*Steenhammera* [or *Stenhammaria* as it ought to be spelt] *maritima*) used to grow on that shore, but it has now disappeared, although it still grows abundantly two miles east from the Pease Dean.

This Dean has little to recommend it botanically, but its scenery is very interesting. One of the best botanical localities in the district

is a glen called Blackburnrigg Dean, about a quarter of a mile from Grant's Station of the N. British Railway. It offers nothing to the eye, yet there are a number of good plants in it, such as *Melica nutans*, *Helosciadium inundatum*, *Pyrola media*, *Chrysosplenium alternifolium*, *Sedum villosum*, *Rubus saxatilis*, *Trientalis europæa*, *Carduus nutans*, *Listera cordata*, *Botrychium Lunaria*. *Poterium Sanguisorba* grows near Barmouth Station, south from Eyemouth. [This plant was found abundantly near St. Abb's Head, by Dr. Balfour's party, two years ago.] *Ranunculus arvensis*, *Lythrum Salicaria*, *Galium boreale*, and *G. Mollugo*, grow near Swinton, and *Ophioglossum vulgatum* near Coldstream, this last being new to the Berwickshire flora.

2. "A short Notice of East Lothian Plants," by J. C. Howden, Esq. In this paper the author mentions the occurrence of *Weissia nigrita* on Gullane Links; and gives a list of plants found by him in various parts of East Lothian; at Presmennan Lake, *Typha latifolia*, *Scutellaria galericulata* and *Carex intermedia*. On the banks of Whittingham Water, *Saponaria officinalis*, *Cichorium Intybus*, *Malva moschata* and *Hyoscyamus niger*. In Ormiston Woods, *Valeriana pyrenaica*, *Convallaria multiflora*, *Polygonum Bistorta*. In Prestonhall Woods, *Helleborus fatidus* has become naturalized; and on the side of the road between Whittingham and Stenton, *Asperula taurina* has fixed itself.

3. "Notice of PIASSABA, a fibrous matter, from South America, used for the manufacture of ropes," &c., by Dr. Balfour. This fibrous matter was sent to Dr. Balfour by Mr. Michael Connal of Glasgow. It is used for the purposes of manufacture in London, and is imported from Bahia, Pernambuco, &c. Dr. Balfour gave a general account of the fibrous matter yielded by Palms, and alluded to the microscopic structure of their woody bundles. He illustrated his remarks by specimens of fibre from the cocoa-nut palm, sago palm, talipot palm, *Livistona chinensis*, and various species of *Chamærops* and *Corypha* growing in the Edinburgh Botanic Garden. He stated that Dr. Arnott had examined the Piassaba fibre, and referred it to the *Attalea funifera* of Martius. The palm is the *Cocos de Piaçaba* of Prince Maximilian's Travels. It attains a height of twenty or thirty feet, and has pinnated fronds fifteen or twenty feet long. The fibres of the petioles and spathes, after maceration, are used for forming very tenacious cables, which resist well the action of salt water. The black fibrous matter resembling whalebone, which is connected with the leaves, has been employed for forming brushes. Specimens of this manufacture were exhibited, also a large drawing of the palm. The fruit of this palm, under the name of Coquilla nuts, is imported into this country. The pericarp is thick and hard, and is used for making handles for umbrellas, drawers, &c. When examined under the microscope, it shows thickened cells very much resembling those seen in bone, the thickening matter being deposited in concentric circles. The seeds have an oily albumen, and a kind of solid palm oil is formed from them. Specimens of the nuts, and the articles made from them, as well as of the solid oil, were shown.

4. "Algæ Orientales" (part 5), by Dr. Greville. In this paper

are described the following new species of East Indian *Sargassa*, *Sargassum obovatum*, *S. Wightii* and *S. cervicorne*. Drawings and dissections were exhibited. The paper will appear in the 'Annals of Natural History' and in the Society's Transactions.

5. "An Account of the Mosses and Hepaticæ growing on the Pyrenees," by Richard Spruce, Esq. (See p. 81 of the present Number.)

MISCELLANEOUS.

On the Existence of an Ovum or Ovule as well in the Male as in the Female of Plants and Animals; producing in the one case Spermatozoa or Pollen-grains, in the other the primitive Cells of the Embryo.
By CH. ROBIN, M.D.*

THE above-named memoir was submitted to a commission, consisting of MM. Serres, Dumas, and Milne-Edwards, and the following report has been drawn up and printed in the 'Comptes Rendus':

"The facts contained in this memoir prove that, in the male organs of plants and of animals, an ovule is formed, analogous to that of the female, and constituted in a like manner; that the vitellus of this ovule divides as does that of the female, and by the same mechanism, giving rise to the development of the embryonary cells, which after being modified by a special evolution constitute pollen-grains or spermatozoa. Thus there is an analogy, and often an identity, between the product of the male generative organs and that of the female. On the other hand, there is an identity in the mode of formation of the embryonary cells in the ovum of vegetables and of animals; and lastly, the mechanism by which the embryonary cells of the male ovule (which are modified to constitute pollen-grains or spermatozoa) are formed, is the same as that which gives birth to the primary cells of the female ovum, the collection of which forms the embryo. Thus the phænomenon of the division of the vitellus, figured and described for the first time among the Vertebrata by Prévost and Dumas, may be extended to vegetables in an equal degree, and it is the expression of a general and unique mechanism, according to which the embryonary cells and zoosperms of all beings are formed.

"A. *Analogy in the mode of formation of the embryonary cells in the ovules of animals and of vegetables.*

"1. It has been for a long time admitted that the ovum of animals appears among the cells of the Graafian vesicles, or the bottom of the ovigerous tubes of the ovary, in the form of a small translucent cell, the nucleus of which is represented by the germinal vesicle. By degrees the transparent contents of the cell become granular and opaque, and constitute the vitellus. At this moment the ovum is fitted for fecundation: it is still but a cell in a morphological point of view; physiologically speaking, however, it has a special nature,—it is a product without an analogue in the body, and set apart for a special function. On the occurrence of fecundation it becomes subject to division, leading to the formation of embryonary cells at the ex-

* The editors are indebted for this communication to J. T. Arlidge, F.R.C.S.L.

pense of the vitellus, within its homogeneous and amorphous envelope—the vitelline membrane.

“2. Referring to cryptogamic plants, nothing is more striking than the identity between the segmentation of the contents of the spores for the development of sporules, or the division of the contents of the latter for the formation of embryonary cells and the like phænomenon in animals (see the works of Thuret and Decaisne). Moreover, one cannot hesitate to compare the spores or the sporules of cryptogamic plants with the ovule of animals,—their homogeneous envelope with the vitelline membrane, and their granular contents with the vitellus. With respect to the differences which, in this point of view, exist between the formation of spores and their germination among fungi and microscopical algæ, they constitute no more than mere varieties of the phænomenon of segmentation, and such are to be met with in higher organizations, and the gradual simplification or degradation may be traced.

“3. In phanerogamous plants the embryonary sac appears in the form of a transparent cell in the nucleus of the ovule: its contents very soon become granular and form a true vitellus. After fecundation two nuclei make their appearance, around which the granular matter of the vitellus collects itself; in the line of separation between these two spherical bodies a dissepiment appears, indicating the formation of the membrane to envelope each of them and to transform them into embryonary cells: this effected, each of the latter subdivide into two, and so on. Here it is still evident that the embryonary cells are formed after the same fashion as in animals, and these facts show that the embryonary sac of phanerogamous plants is the only part of them comparable with the ovum of animals. We have in it the true ovule of plants, in the form of a cell, soon displaying a homogeneous envelope or vitelline membrane, and a granular interior or vitellus. As to the primine, secundine, and nucleus or tercine, these are but organs composed of cellular tissue, organs of protection or of nutrition, and accessory only to the essential part—the ovule.

“B. *Analogy between the product of the male organs and that of the ovaries of the female among plants and animals, and identity between the mode of formation in the male ovule of the grains of pollen or of spermatozoa, and that of the embryonary cells in the female ovule.*

“1. All botanists agree in describing, in each half of the young anther, the development of large cells, out of which the grains of pollen are formed, and which are called the parent-cells of pollen, or pollen-utricles. These utricles are made up of granular contents, constituting a true vitellus analogous to that of the vegetable ovule, and inclosed by a homogeneous wall, or vitelline membrane. In the vitellus, at first two, and afterwards four nuclei appear, around which the vitelline granules congregate, in such a way as to form so many small spheres, each of which soon becomes furnished with an inclosing envelope. These cells thus formed, after some modification of their walls, constitute grains of pollen. The analogy in the formation of the latter to that of the embryonary cells in the ovule, or embryonary sac of the plant, cannot fail to be observed, in

every point, except in that the embryonic cell of the male ovule whilst retaining its cell-form, has become a special organ, endowed with a special property, viz. fecundation by the intromission of the pollen-tube into the ovule: whilst in the female ovule, on the contrary, the embryonary cells analogous to those of the male ovule are metamorphosed into anatomical elements (tracheæ, dotted vessels, cellular tissue, &c.)."

The reporters go on to observe:—"2. That the facts contained in this part of the (M. Robin's) memoir demonstrate that, in cryptogamic plants, the antheridia must be regarded as the analogues of the male ovules of vegetables: they are formed, in fact, of a homogeneous envelope,—the vitelline membrane, and contain a granular mass,—the vitellus. At the expense of this vitellus are formed the moveable animalcules of algæ, mosses, &c., the true spermatozoa of algæ, as believed by MM. Thuret, Decaisne, and Montagne, &c. The observations of M. Robin tend also to show, that the spermatozoa of many algæ have sometimes been confounded with spores provided with vibratile cilia, or zoospores; and he describes, after some original observations, the development of those of *Ulva lactuca*. He states that in this plant the granular contents, or vitellus of the cells of the frond,—which fulfil the office of antheridia, or of the male ovule, become broken up into two, four, or eight, or into as many as twelve, twenty-four, and even thirty-two segments, or little spheres, after the same plan as prevails in the division to form pollen grains, or vegetable, or animal embryonic cells. Very soon four cilia are developed on one point of the surface of these spherules, and then the latter escape from the ruptured antheridium, evincing very active movements. With respect to cryptogamic plants, the male fecundating corpuscles of which are as yet undiscovered, further researches are necessary.

"3. M. Reichert has watched the development of the spermatozoa in the *Strongylus auricularis*, and in the *Ascaris acuminata*. In the first stage, some transparent cells spring up at the bottom of the testicular tubes, each provided with a germinal vesicle, the contents of which soon become granular, and assimilate it to the vitellus of the female ovum; whilst the envelope appears homogeneous and amorphous, like the vitelline membrane: in short, it is a true ovule, similar in every respect to one of known female origin. The vitellus very soon divides into two spheres, then into four, each of which gets inclosed by a wall, and constitutes an embryonic cell: by degrees each cell thus produced changes its form, and at the same time a prolongation makes its appearance at one of its poles, which forms the tail of the spermatozoon, the cell itself forming the head or body. M. Ségond has, in conjunction with M. Robin, also noted this identity of the male and female ovule in the blue Rhizostoma (*Rhizostoma Cuvieri*), as well as some of the phænomena of the evolution of the vitellus.

"Résumé.—1. It is seen that an ovule is formed in the male organs analogous to that derived from the ovary; that in the male ovule grains of pollen or zoosperms are developed, after the same manner as the primitive cells of the embryo are formed in the female ovule, and hence these fecundating corpuscles are the analogues of the em-

bryonary cells, with this constant difference, that they are themselves spontaneously formed, and become the determining cause of the evolution of the latter.

“2. As to the development of the tail, or the vibratile cilia of the spermatozoa of algæ and of animals, and the movements they present, these are not more astonishing than the formation of vibratile cilia on the surface of epithelial cells of mucous membrane, and both are, without doubt, of the same, and as yet unknown, nature. But the movements they exhibit are not of themselves sufficient to characterize spermatozoa as animals, no more than the carrying about of an epithelial cell, or of a spore of fucus by the agency of cilia can constitute either of those an animal; in fine, they are no more animals than are embryonic cells.

“3. It being once recognised that an ovule is formed by the male apparatus analogous to that produced by the female, and presenting an identity with the latter in its evolution, two series of ovules may be naturally formed:—

“A.—Of male ovules.

“1. Those of animals (parent zoospermic utricles).

“2. Those of cryptogamic plants (antheridia, or cells fulfilling their purpose in the *Ulvaceæ* and other cryptogamia).

“3. Those of phanerogamous plants (parent-cells of pollen).

“B.—Of female ovules, or ovules strictly so called.

“1. Those of animals (ova).

“2. Those of cryptogamic plants (spores, some zoospores, sporules).

“3. Those of phanerogamic plants (vegetable embryonary sac).

“All ovules or ova are constituted essentially of a vitellus with its germinal vesicle and vitelline membrane. But in the male ovules the division of the vitellus is a primitive phenomenon, spontaneous, and always limited to the formation of spermatozoa—the true embryonary cells of the male, which have the property of determining in the female ovule the same phenomenon (self-division) which has given them birth, and which proceeds in the latter to the evolution of the embryo. The female ovules, on the contrary, form the second series of organs, the vitellus of which, in order to become divided in its turn, and to form the primary cells of the embryo, needs the concurrence of the spontaneously developed products of the male vitellus.”—*Comptes Rendus*.

On the Gum Kino of the Tenasserim Provinces.

By the Rev. F. MASON.

In a valuable article by Dr. Royle on Gum Kino, reprinted in the Journal of the Agricultural and Horticultural Society of India, which ostensibly enumerates all the various regions from which it has been imported into England, there is no mention of this article being imported from this coast. Yet long before Dr. Royle compiled that communication, more than one consignment had been made by parties in Maulmain to houses in London of gum kino to the amount of a thousand pounds.

It was brought to Maulmain by an English merchant from the

Shan States, and stated by him, as our commissioner at the time informed the writer, to be the production of the *Pa-douk*, the same tree as the one in Maulmain thus denominated by the Burmans. Several years before I had directed attention to this tree as producing an astringent gum resembling gum kino, but the medical officer to whom I submitted specimens of the gum said it was "a kind of dragon's blood;" but after it was known that the gum of the *Pa-douk* had been sold in London for the veritable gum kino, another medical gentleman tried in his practice the exudation of the tree in his compound in the place of the gum kino in his stores, and reported the effects the same, that their medical virtues were alike.

The next inquiry that arises is for the genus and species of the *Pa-douk*. When I first came to the coast, all the English residents of my acquaintance called it "Burman Senna," and the surgeon of the station told me that he believed it was a species of senna. The Rev. H. Malcom, D.D., President of Georgetown College, Kentucky, who came out to India a dozen years ago in order to go back again and write a book, has stereotyped in his travels,—"*Pa-douk*, or *Mahogany* (*Swietenia Mahogáni*), is plentiful in the upper provinces, especially round Ava, found occasionally in Pegu." In a native Pali dictionary, found in the Burmese monasteries, *Pa-douk* stands as the definition of *Pe-tá-thá-lá*, and the corresponding Sanscrit word in Wilson's Dictionary is defined *Pentaptera*; but the *Pa-douk* does not belong to that genus. In Piddington's Index however *Peetshala* stands as the Hindee name, and in Voigt's Catalogue *Peet-sal* as the Bengalee name of *Pterocarpus marsupium*; and this brings us nearer the truth, for *Pa-douk* is a name common to two different species of *Pterocarpus*, but which look so much alike that they are usually regarded as one species. Undoubtedly one species is *P. Indicus*, and the other I presume is the one named by Wight *P. Wallichii*, but which was marked in Wallich's Catalogue *P. Dalbergioides*, from which it differs in no well-marked character excepting that the racemes are axillary and simple, while in the latter they are terminal and "much-branched." Wight says of *P. Wallichii* in his Prodrômus, "stamens all united or split down on the upper side only;" so they are sometimes in our tree. In the figure that he gives in his Illustrations they are represented as diadelphous, nine and one, and so they are seen occasionally in our tree; but the more common form is that of being split down the middle into two equal parts, of five each, as in *P. Dalbergioides*. The wood too resembles it. "Not unlike mahogany, but rather redder, heavier and coarser in the grain." It is often called "red wood" at Maulmain; and from the colour of the wood, some of the natives distinguish the species "red *Pa-douk*," being *P. Dalbergioides*, and "white *Pa-douk*," *P. Indicus*.

Both these trees produce an astringent gum, which has been exported for gum kino; or whether it was a mixture of both it is not possible to say. Probably the latter, as the native collectors would not probably make any distinction. Possibly it is the production of neither. It may be that *P. marsupium* is found in the Shan States, for it grows I believe in Assam; and the man that did not distin-

guish the two species in Maulmain, would not distinguish them from a third at Zimmay. Be that as it may, this is certain, that these provinces can furnish the commercial world with a large quantity of gum kino. If the result of the experiment which was made be correct, we have a great abundance of it within our own borders; for the Pa-douk is one of the most common forest trees in the provinces from the Tenasserim to the Salwan. It furnishes a considerable portion of the fuel that is sold in Maulmain. But if not, it is certainly abundant in the neighbouring provinces, whose only avenue to market is through our territories.—*Journal of the Asiatic Society of Bengal*, August 1848.

METEOROLOGICAL OBSERVATIONS FOR DEC. 1848.

Chiswick.—December 1. Foggy and drizzly: cloudy: rain, and boisterous at night. 2. Fine. 3. Clear: overcast: boisterous, with rain at night. 4. Boisterous, with heavy rain: clear at night. 5. Overcast: clear: slight rain. 6. Clear: heavy clouds. 7. Rain. 8. Slight rain. 9. Very fine. 10. Clear and very fine. 11. Foggy: cloudy. 12. Foggy: uniformly overcast. 13. Exceedingly fine. 14. Fine. 15. Hazy: rain. 16. Drizzly: constant heavy rain. 17. Cloudy: foggy. 18. Hazy: fine: densely overcast. 19. Foggy. 20. Hazy: clear and frosty at night. 21. Clear and frosty. 22. Frosty: clear: frosty. 23. Foggy: hazy: sharp frost. 24. Frosty: slight haze: overcast. 25. Hazy: cloudy. 26. Densely clouded. 27, 28. Fine. 29. Overcast. 30. Foggy: fine: foggy. 31. Foggy: hazy: foggy at night.

Mean temperature of the month 41°·75
Mean temperature of Dec. 1847 41 ·09
Mean temperature of Dec. for the last twenty years 39 ·66
Average amount of rain in Dec. 1·58 inch.

Boston.—Dec. 1. Cloudy: rain A.M. and P.M. 2. Fine. 3. Fine: rain P.M. 4. Cloudy: rain P.M. 5. Cloudy: rain A.M. 6. Fine: rain A.M. 7. Rain: rain A.M. and P.M. 8. Fine: rain P.M. 9—11. Fine. 12. Cloudy. 13. Fine. 14. Cloudy: rain P.M. 15. Cloudy: stormy, with rain from S.W. P.M. 16. Cloudy: rain P.M. 17, 18. Fine. 19. Rain: rain early A.M. 20. Cloudy. 21. Fine: plenty of ice this morning. 22—24. Fine. 25, 26. Rain. 27, 28. Cloudy. 29. Fine. 30. Cloudy. 31. Cloudy: a remarkable dark day.

Applegarth Manse, Dumfries-shire.—Dec. 1. Frost A.M.: rain and high wind P.M. 2. Rain: sleet: high wind: lightning. 3. Snow inch deep: heavy rain P.M. 4. Very high flood: heavy rain and high wind. 5. Fair, after very wet night: flood again. 6. Dull: drizzling: frost A.M. 7. Frost: damp and drizzly P.M. 8. Soft, moist and foggy. 9. Rain all day: high wind P.M. 10. Fair: high wind. 11. Fair and fine. 12. Dull and foggy A.M.: rain P.M. 13. Rain A.M.: showery all day. 14. Fair A.M.: rain and high wind P.M. 15. Fair A.M.: rain P.M., with storm of wind. 16. Fair and fine. 17. Frost A.M.: slight showers P.M. 18. Fair A.M.: cloudy: showery P.M. 19. Fair: fog: cleared P.M. 20. Frost: thaw P.M. 21. Frost, hard: clear and bracing. 22. Frost very hard: clear. 23. Frost keen: clear: wind rising. 24. Frost: high wind P.M. 25. Frost, slight: thaw P.M. 26. Rain very heavy: high wind. 27. Fair and clear: threatening frost. 28. Hard frost all day. 29. Hard frost. 30. Frost moderate: dull. 31. Frost moderate: cloudy.

Mean temperature of the month 39°·8
Mean temperature of Dec. 1847 40 ·2
Mean temperature of Dec. for the last twenty five years . 38 ·2
Average amount of rain in Dec. for twenty years 2·94 inches.

Sandwich Manse, Orkney.—Dec. 1. Hoar-frost: rain. 2. Cloudy. 3. Rain: cloudy. 4. Showers: thunder: hail-showers. 5. Hoar-frost: showers. 6. Bright: showers. 7. Bright: clear. 8. Showers: rain. 9. Cloudy: rain. 10. Hazy: rain: clear. 11. Cloudy: clear. 12. Cloudy: rain. 13. Bright: showers. 14. Cloudy. 15. Bright: rain. 16. Showers: clear. 17. Showers: cloudy. 18. Cloudy. 19. Bright: clear. 20. Cloudy. 21. Bright: clear: aurora. 22. Clear: frost: clear: aurora. 23. Clear: frost: clear. 24, 25. Cloudy. 26. Rain: cloudy. 27. Showers: clear. 28, 29. Clear: frost: clear. 30, 31. Cloudy.

Days of Month.	Barometer.				Thermometer.						Wind.				Rain.			
	Chiswick.		Dumfries-shire.		Orkney, Sandwick.		Chiswick.		Boston.	Dumfries-shire.		Orkney, Sandwick.	Chiswick.	Boston.	Dumfries-shire.	Orkney, Sandwick.		
	Max.	Min.	8 a.m.	9 a.m.	94 a.m.	84 p.m.	Max.	Min.										
1848. Dec.																		
1.	29.644	29.355	29.36	28.93	29.42	28.82	48	34	37.5	43	34½	34	39	sw.	s.	sw.	.19	.05
2.	29.612	29.362	28.96	29.12	28.69	28.94	45	29	37	41½	36½	37	37	sw.	sw.	sw.	.02	.50
3.	29.797	29.579	29.90	29.03	29.09	29.16	51	36	33	44½	31	40	39	sw.	w.	se.	.01	.47
4.	29.268	29.116	28.80	28.58	28.74	28.72	53	38	50	48½	40	45	39	sw.	s.	n.	.19	.55
5.	29.215	28.986	28.50	28.87	28.70	28.73	53	39	42	43½	36	38	40	sw.	ws.	nw.	.01	.61
6.	29.376	29.215	28.84	28.97	28.70	28.93	47	40	40	41	32	40	38	sw.	ws.	ne.	.05	.30
7.	29.670	29.505	29.17	29.39	29.33	28.51	55	50	42	40½	30	38	35	s.	s.	w.	.15	.07
8.	30.015	29.775	29.30	29.61	29.51	29.56	57	48	55	49½	32½	38	41	sw.	ssw.	n.	.01	.20
9.	30.253	30.130	29.58	29.77	29.69	29.53	57	33	51	50½	46	42	47	sw.	ssw.	s.	.....	.16
10.	30.273	30.155	29.73	29.88	29.77	29.61	60	29	47	52½	48½	51	47	sw.	ssw.	s.	.01	.....
11.	30.160	30.038	29.64	29.90	29.55	29.76	60	38	43	53	47½	49	47	sw.	s.	sw-w.	.....	.....
12.	30.164	30.097	29.70	29.70	29.80	29.56	55	37	51	51	43	45	49	sw.	w.	s.	.....	.....
13.	30.029	29.978	29.55	29.67	29.41	29.59	58	34	45	52	49	49½	46½	s.	s.	s.	.....	.....
14.	29.831	29.732	29.37	29.48	29.41	29.47	52	40	44	54	50	49	47	s.	s.	sse.	.14	.....
15.	29.810	29.640	29.49	29.18	29.56	28.68	55	43	45½	53½	42½	41	45	s.	calm	s	.22	.05
16.	29.800	29.731	29.38	29.60	29.23	29.52	42	38	45	46	37	43½	41	ne.	s.	ssw.	.68	.35
17.	29.937	29.872	29.54	29.63	29.47	29.54	48	33	37	43	32	42	43	ne.	calm	s-sw.	.01	.07
18.	29.856	29.771	29.48	29.48	29.55	29.55	52	43	40	44	37	43	44	s.	calm	sse.	.01	.....
19.	30.094	29.808	29.50	29.75	29.81	30.05	48	40	46	44	37	41½	41	ne.	calm	e.	.01	.12
20.	30.301	30.172	29.93	30.10	30.15	30.19	40	24	40	43½	32	45	41	ne.	sw.	e.	.....	.....
21.	30.334	30.315	30.06	30.23	30.18	30.20	34	23	33.5	33	27	37	36	e.	e.	e.	.....	.....
22.	30.345	30.211	30.14	30.30	30.26	30.39	39	22	32	38	23½	37	35	e.	e.	ne.	.....	.....
23.	30.343	30.204	30.13	30.18	30.42	30.32	33	21	35	37	28	39	38½	e.	e.	se.	.....	0.12
24.	30.093	29.706	29.83	30.00	30.18	30.03	40	26	35	37	33½	40	40½	e.	ese.	ese.	.02	.....
25.	30.046	29.836	29.60	29.80	29.90	29.90	49	35	37	42	34	42	44	ne.	se.	e.	.....	.....
26.	30.024	29.975	29.70	29.38	29.51	29.42	51	40	42	49	39	45	43	s.	e.	ese.	.....	.08
27.	30.103	29.985	29.15	29.74	29.64	30.00	49	39	48.5	48½	43	42	44	w.	sw.	nw.	.30	.25
28.	30.166	29.985	29.76	30.04	30.09	30.13	44	39	48	46½	36½	36	36	ne.	w.	s.	.....	.....
29.	30.180	30.149	29.92	30.10	30.09	30.13	44	30	29	35	25	37	40	n.	calm	nw.	.....	.....
30.	30.170	30.084	29.30	30.02	30.15	30.13	40	29	37	36½	29½	39	39	ne.	calm	e.	.....	.....
31.	30.126	30.110	29.90	30.10	30.13	30.20	40	30	37	35	32	39	37	ne.	calm	e.	0.50
Mean.	29.968	29.824	29.52	29.646	29.620	29.584	48.67	34.82	41.1	44.5	35.5	37.5	37.5

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XVIII.—*Observations upon several genera hitherto placed in Solanaceæ, and upon others intermediate between that family and the Scrophulariaceæ.* By JOHN MIERS, Esq., F.R.S., F.L.S. &c.

My attention during the last few years having been directed to the study of the *Solanaceæ*, I have given the results of this inquiry in a series of memoirs in the 'Lond. Journ. Bot.,' vols. iv., v. and vii., and also in the 'Illustration of South Amer. Plants,' where delineations are offered of the peculiar features of each genus. Having at length completed the analysis of the remaining genera of this order, the results will be given in succession in this Journal; but in order to explain my views in regard to that family, the following observations are necessary.

Following the track I had marked out as the basis of these investigations, which has been chiefly to satisfy myself by careful analysis of the true limits that serve to separate different genera, I have encountered a number of facts which are very difficult to reconcile with our present distribution of the *Solanaceæ*, and which have induced me to carry this inquiry much further than was at first contemplated. These results having been published at intervals, as they presented themselves, the order in which they have appeared is necessarily imperfect in a systematic point of view; but as my principal object has been to arrive at truth, I expect some degree of indulgence, for what may appear as defects of arrangement and want of plan. I have alluded to the increasing number of novel cases that have offered themselves during this inquiry, which render it difficult to decide whether certain genera should be classed in *Solanaceæ* or in *Scrophulariaceæ*, as these natural orders are at present considered; and in consequence of the accumulation of these anomalies, it appears at length necessarily expedient to draw a more certain line of distinction between these two important natural orders. This difficulty is not new in the history of the science, for nearly forty

years ago it did not escape the acute penetration of our distinguished countryman Mr. Robert Brown, who then suggested the plan of avoiding it by the establishment of an intermediate family*. Another of the great botanists of our time, Mr. Bentham, who has made the *Scrophulariaceæ* one of the chief objects of his study, and to whom we are indebted for the admirable monograph of that order in the 10th volume of the 'Prodromus' of DeCandolle, published only two years ago, although evidently aware of this necessity, has never carried it into execution: the tribe of the *Salpiglossideæ*, which he placed at the head of the *Scrophulariaceæ*, was manifestly framed under a point of view bearing toward this end; and in the addenda to the same volume of the 'Prodromus,' p. 595, he offers some remarks upon what I had previously hinted, respecting the separation of the genus *Lycium* from the *Solanaceæ* (Lond. Journ. Bot. v. 183).

The establishment of the *Salpiglossideæ* in the manner just mentioned, has however in no degree removed the objections before existing, and from the facts which I shall now have to communicate, these exceptions will be seen increased to a manifold amount, for it is now evident that a considerable number of genera, hitherto placed in *Solanaceæ*, possess a regular corolla, with a 5-lobed border, offering an imbricate æstivation, contrary to the usual structure of the order, and although possessing five stamens, one is often smaller, and sometimes sterile, showing an evident tendency towards the structure of the *Scrophulariaceæ*; and thus, besides *Lycium* and some of the genera of the *Salpiglossideæ*, we have now *Petunia*, *Nierembergia*, *Solandra*, *Juanullos*, *Marckea*, *Hyoscyamus*, *Atropa*, *Mandragora*, *Nicandra*, *Anisodus*, &c. &c., forming too important a number of exceptional cases to be passed over in neglect. Having lately examined with much care the structure of most of these genera, I am now better prepared to carry out the views, which I hinted at three years ago, in an earlier stage of this inquiry (Lond. Journ. Bot. v. 152), where I suggested the propriety of associating these dissident genera in a distinct and intermediate tribe or family.

I therefore now propose definitely to confine the *Solanaceæ* as

* *Solanaceæ*, "a Scrophularinis distinguuntur præcipue embryo arcuato vel spirali et corollæ æstivatione plicata, floribusque sæpissime regularibus isostemonibus. Hinc genera corolla non plicata et simul embryo recto, vel excludenda, vel cum iis corolla imbricata, embryo leviter arcuato, staminibusque didynamis in propria sectione disponenda, futuri ordinis initia."—*Prodr.* p. 444.

From the state of our knowledge at that time, it is evident that these allusions were intended to apply principally to the *Verbasceæ*, which by Jussieu, Linnæus and most preceding botanists were classed among *Solanææ*, but they certainly may be referred with additional force to the instances alluded to above.

nearly as possible within the limits prescribed by Mr. Robert Brown in his 'Prod.' (*loc. cit.*), viz. to those genera with a monopetalous corolla, with a 5-, rarely 4-partite border, even in exceptional cases nearly regular and equal, the borders of whose lobes are always valvate or induplicato-valvate in æstivation; epipetalous stamens, alternate with and equal to the number of the lobes, the fifth being seldom shorter and still more rarely sterile, anthers always bursting by longitudinal slits or pores; an ovarium most generally 2-celled, rarely 3- to 5-locular, with a simple style, a bilobed or clavate stigma often hollow; a fruit either capsular or baccate, and albuminous seeds with a terete embryo, straight, and more or less curved in a nearly annular form, or somewhat spiral, the radicle in all cases pointing to the basal angle of the seed, and turned away to some short distance from the hilum, which is generally lateral and marginal, rarely almost basal.

The *Scrophulariaceæ* I would also propose should be confined to those genera that possess a tubular corolla more or less curved and irregular, with a 4- or 5-partite border generally unequal and bilabiate, the lobes rarely equal, but in every case with a decidedly imbricate æstivation; stamens 2 or 4, didynamous, seldom with a fifth, which is very rarely fertile, often only rudimentary: an ovarium, most generally bilocular; a simple style, with a stigma more or less bilabiate or bilobed; the fruit almost always capsular (in very few instances baccate), 2-locular, rarely more-celled, bursting in various ways, with central placentæ adnate to the dissepiment, and an embryo enveloped in albumen but little curved, generally with the radicle pointing to a basal hilum*; in one solitary instance (*Campylanthus*) the embryo is however perispherically curved. In this very natural family, although the floral leaves are often alternate, the cauline leaves are most generally opposite, which occurs only accidentally in *Solanaceæ*, and the origin of the inflorescence is strictly axillary. Thus limited, they form a very distinct natural order.

The intermediate group, which I now propose as a suborder, under the name of *Atropineæ*, or as a new order, under that of *Atropaceæ*, will consist of genera having a tubular persistent calyx, more or less deeply divided, a hypogynous tubular corolla, with the tube more or less plicated in bud, and with a border generally divided into 5 lobes slightly unequal, but which are

* According to Mr. Bentham's authority, DeCand. 'Prod.' x. p. 186, and a statement positively affirmed by most botanists, but one which, it appears to me, must be received with some modification; for in the seemingly truthful analyses of the genera figured by Nees v. Esenbeck, 'Gen. Pl. Germ.', the radicle is shown as in *Solanaceæ*, not pointing directly to the hilum. See plates of *Erinus*, *Veronica*, *Wulfenia*, *Odontites*, *Euphrasia*, *Bartsia*, *Pedicularis*, and *Alectorolophus* (*Rhinanthus*).

always either imbricately disposed in æstivation or arranged under some modification between that form and the plicate, but never valvate, the margins of each lobe being constantly free from those of the adjoining ones; they have generally 5 fertile epipetalous stamens, alternate with the lobes, with one of them sometimes a little shorter, 1 or 3 being very rarely sterile; anthers bilobed, with the lobes parallel, bursting longitudinally at the margin, one of these lobes being sometimes sterile; the ovary 2-celled, rarely 5-locular, with ovules generally ascending, attached to fleshy placentæ which are adnate to the dissepiments, as in *Solanaceæ* and *Scrophulariaceæ*, a simple style, and a bilobed stigma often of a very peculiar form; the fruit is either baccate or capsular, the seeds generally reniform or compressed, with a lateral hilum; the embryo, placed in albumen, is either straight or more or less curved, sometimes perispherically or spirally. They are plants with much the habit of the *Solanaceæ*, with alternate, simple or geminate leaves, many of them possessed of powerfully medicinal properties.

They offer the peculiarity, distinct from *Scrophulariaceæ*, and similar to that of the *Solanaceæ*, in having the origin of the inflorescence always somewhat extra-axillary and lateral in regard to the insertion of the petiole. I propose to arrange them in the following manner:—

ATROPINEÆ OR ATROPACEÆ.

- | | | |
|---|---|--|
| Tribe 1. <i>Nicotianeæ</i> . Corolla with an elongated funnel-shaped tube, often more or less hypocrateriform, with 5 nearly equal lobes, which are conduplicate and then twisted in æstivation, as in <i>Convolvulus</i> : stamens 5, one frequently shorter; anthers 2-lobed, lobes almost free, medifixed, and without connective, bursting laterally along the outer edge: capsule 2-locular with bifid valves, the margins of which are somewhat septicial, and slightly inflexed at base: seeds with a short terete embryo somewhat incurved or slightly arcuate. | } | <i>Nicotiana</i> ,
<i>Lehmannia</i> ,
<i>Sairanthus</i> ,
<i>Polyclidia</i> . |
| Tribe 2. <i>Datureæ</i> . Corolla with an elongated funnel-shaped tube, having a 5-angular expanded border with a contorted complicated æstivation, as in the <i>Nicotianeæ</i> : 5 equal stamens; anthers 2-lobed, lobes linear, laterally adnate, dorsally attached to a fleshy connective, and bursting longitudinally in front: fruit sub-baccate or capsular, 2-celled above, 4-celled below, with the fleshy placentæ adnate to the middle of the dissepiment: seeds with a nearly annular curved terete embryo. | } | <i>Datura</i> ,
<i>Ceratocaulis</i> ,
<i>Brugmansia</i> . |

- Tribe 3. *Duboisieæ*. Corolla with a tube either elongated and ventricose above, or short and rotate, with a 5-lobed border, the lobes being diversely volutive in æstivation : 5 equal stamens or 4 didynamous with the rudiment of a fifth ; anthers rounded, cordate, always extrorse, either 2-celled, with the cells confluent at the apex, or unilocular with a hippocrepiform line of dehiscence, and gaping transversely as in *Verbascum* : ovarium 2-locular, with numerous ovules affixed to thickened placentæ adnate to the dissepiment : fruit either baccate or capsular, 2-valved, with septicidal dehiscence : terete embryo in albumen, slightly curved.
- } *Duboisia*,
} *Anthocercis*,
} *Anthotroche*.
- Tribe 4. *Schizanthææ*. Corolla deeply cleft into several irregular divisions, with a somewhat reciprocative æstivation : stamens 5, of which 3 are sterile ; style erect, with a small fistulose stigma, slightly swollen below, its contracted entire margin filled with a globose viscous gland : capsule 2-celled, 4-valved, seeds with a terete hemicyclically arcuate embryo.
- } *Schizanthus*.
- Tribe 5. *Salpiglossideæ*. Corolla more or less ventricose above, sometimes contracted in the mouth, the border being divided into 5 nearly equal regular segments, one of them always somewhat larger and more erect, their æstivation being reciprocative (see p. 172) : stamens 4, didynamous, sometimes with the rudiment of a fifth ; anthers 2-lobed, lobes divaricate at base, connected at apex by intervening filament, one of the lobes being sometimes reduced to a small lateral dehiscent gland : style winged at its apex or expanded into a remarkable tongue-shaped process, which is stigmatose at its emargination : fruit capsular, 2-locular, 2-valved : embryo slightly curved, much more so in *Salpiglossis*.
- } *Salpiglossis*,
} *Pteroglossis*,
} *Leptoglossis*,
} *Browallia*.
- Tribe 6. *Petunieæ*. Corolla with an elongated tube, sometimes hypocrateriform, seldom with the rudiment of a palate, the border being divided into 5 nearly equal, rounded and emarginated lobes, their æstivation in *Petunia* being replicative (see p. 173), in *Nierembergia*, replicative at the base of the lobes, with a perfectly quincuncial imbrication at their summits : stamens 5, one of which is shorter, 2 longest ; anthers 2-lobed, divaricate at base, without connective : stigma expanded into a remarkably tongue-shaped form, emarginate at its apex, in *Nierembergia* embracing the anthers : capsule and seed as in *Salpiglossideæ*.
- } *Petunia*,
} *Nierembergia*.

- Tribe 7. *Hyoscyameæ*. Corolla tubular, more or less expanded in the mouth in a campanular form, with the border divided into 5 equal rounded lobes: stamens 5, equal; anthers 2-lobed, affixed to a narrow dorsal connective above, free below, and bursting longitudinally in front near the margin: ovarium 2-celled, and singularly surmounted by a fleshy epigynous gland, which is either small and stylobasic, or else enveloping the upper moiety of the ovarium: fruit an exsuccous berry, which sometimes bursts by a circumscissile line on the margin of the gland: embryo terete, annular, and somewhat spiral.
- Hyoscyamus, Scopolia, Physoclena, Cacabus, Thinogeton.*
- Tribe 8. *Atropeæ*. Corolla tubular, more or less campanular, with a border divided into 5 equal rounded lobes, which are imbricate in æstivation: stamens 5, equal; anthers ovate, 2-lobed, lobes laterally adnate, reversed in *Atropa* by the deflexion of the filaments: fruit baccate, 2- or 5-celled, fleshy, often somewhat exsuccous: embryo terete, nearly perispherical.
- Atropa, Nicandra, Cliocarpus, Anisodus, Mandragora, Lycium.*
- Tribe 9. *Solandreæ*. Corolla generally with an elongated, straight, rarely a short tube, in no degree plicated in bud, border 5-cleft into more or less rounded equal lobes: 5 equal stamens, generally epipetalous, but sometimes arising from the outside of a free ring, attached to the base of the corolla; anthers oblong, 2-celled, cells parallel and adnate upon a dorsal connective, and bursting longitudinally in front: fruit a fleshy 2-locular berry, and seeds with a nearly straight terete embryo, with a lax testa, as in the *Cestrineæ*.
- Solandra, Marckea, Juanullosa, Sarcophysa, Ectozoma.*
- Tribe 10. *Brunsfelsiæ*. Corolla with a more or less elongated tube, somewhat ventricose below the contracted mouth, border divided into 5 nearly equal segments, their æstivation being decidedly imbricative (unknown in *Heteranthia*): stamens didynamous, somewhat inflected at the apex, with one pair shorter; anthers unilocular and hippocrepiform, as in the *Verbasceæ* and the *Duboisieæ*: style slender: stigma small, bilobed, and simply clavate, or with the lobes somewhat gaping: fruit either capsular or baccate, with a nearly straight embryo.
- Brunsfelsia, Franciscea, Heteranthia.*

The *Solanaceæ*, *Atropeæ* and *Scrophulariaceæ*, as here defined, evidently constitute an alliance, bound together by very striking and peculiar characters, distinguishable in the structure of their corolla and ovarium, but more especially in that of their

fruit, which is most generally 2-celled, with many seeds fixed to thickened placentæ adnate to the dissepiment, and having a terete embryo, more or less curved, with an inferior radicle, characters that are common to the whole of this large group. So gradual is the transition from one link to another of this chain, that it is difficult to discover any decided break in their continuity, but notwithstanding this, they form too large an assemblage to constitute one single family. The *Solanaceæ*, as distinguished from the *Scrophulariaceæ* in general, exhibit characters sufficiently marked, but the difficulty lies with the large intermediate group above indicated, that equally partake of the features of both these extremes. I am quite averse to the practice of multiplying unnecessarily the amount of natural orders beyond the smallest possible number: it is not therefore any idle notion of proposing a new family that leads now to this suggestion, which would defeat its own object unless supported by facts, and urged by the necessity of the case; but it is the desire of grappling with a formidable obstacle, that would otherwise prevent us from establishing any decided limits between these two great families. If this difficulty presented itself to me in so prominent a degree three years ago (*Lond. Journ. Bot.* v. 183, *note*), when I first noticed the anomaly in *Lycium*, and suggested its separation from *Solanaceæ* on that account, with how much more force must this discrepancy present itself, when the exceptionable cases now amount to so extensive an accumulation in point of number! The æstivation of the corolla has hitherto been considered to form an unerring line of demarcation between the *Solanaceæ* and *Scrophulariaceæ*, but if we place in the former family a large proportion of genera possessing an imbricate æstivation, and offering frequently nearly anisomerous flowers (characters peculiar to the last-mentioned order), we lose at once the only valid features that can serve to discriminate the boundaries of these great families. It is clear that the intermediate group here proposed to be collected together can only be disposed of in three modes: they must be associated either with the *Solanaceæ*, or be attached to the *Scrophulariaceæ*, or else they must remain as a distinct family. In the first case, the *Solanaceæ* would be then divided into two suborders: 1. the *Solanineæ*, having a corolla with valvate æstivation; and 2. *Atropineæ*, with imbricate æstivation. In the second case we should associate, 1. *Atropineæ*, with flowers nearly isomerous; and 2. *Scrophularineæ*, with anisomerous flowers. In either of these two cases we find that inconsistency to a great extent would be unavoidable; for in the former instance we admit a large circle of exceptions to the only leading characteristic mark of the order; and in the second case we include a considerable number of genera, nearly isomerous, in a

family whose principal feature is to possess anisomerous flowers ; but in the third case we avoid these difficulties and ensure consistency, preserving at the same time the peculiar characteristic features both of the *Solanaceæ* and *Scrophulariaceæ* : we should then have thus, 1. *Solanaceæ*, offering isomerous flowers with a valvate or induplicato-valvate æstivation ; 2. *Atropaceæ*, isomerous flowers, or nearly so, with imbricate or a peculiar æstivation ; and 3. *Scrophulariaceæ*, anisomerous flowers with imbricate æstivation. In any of the three modes of distribution above indicated, it matters little which we adopt, in regard to the absolute arrangement of the various genera, for in every case they remain alike, in exactly the same linear order of position. The value of the *Atropaceæ*, as a distinct order, must now rest entirely on its own intrinsic merits : its adoption seems the only course by which a large amount of inconsistency can be removed, and it appears to me a far less objectionable plan to call up a new family, than to destroy the great landmarks that serve to discriminate the limits of two of the most natural families in the system.

Having shown the arrangement proposed for the distribution of the *Atropaceæ*, I must offer the following explanation. The division into the suborders *Rectembryeæ* and *Curvembryeæ*, as proposed by Endlicher, and followed by me in the arrangement of the *Solanaceæ* formerly given in 'Lond. Journ. Bot.' v. 148, offers by far too inconstant and doubtful a character to be maintained there, or be adopted here ; for among the *Salpiglossideæ*, some species of *Petunia* possess an embryo nearly straight, and more curved in others, while in *Salpiglossis* it is often spirally bent into more than a complete gyration. I have preferred rather to follow the æstivation of the corolla, as it gradually verges from the plicato-valvate of the *Solanaceæ* into the imbricate mode of the *Scrophulariaceæ* : thus in the tribes *Nicotianeæ* and *Datureæ* we have the contorto-conduplicate, a form by no means valvate, but the first departure from it : in the *Duboisieæ* we have another advance, where the lobes of the border are seemingly valvate, but on examination their margins will be found convolutely inflected, a form which I have named volutive : in the *Salpiglossideæ* it assumes the next step here denominated reciprocative : in the *Petunieæ* we have again another degree, which is only a modification of the imbricative, and which I have termed replicative : and finally, in the *Hyoscyameæ*, *Atropeæ*, *Solandreæ* and *Brunsfelsieæ*, it becomes decidedly imbricative and quincuncial, as in the *Scrophulariaceæ*, with which natural order the latter tribe most closely osculates. In the *Atropeæ* the amount of imbrication is small in extent ; in the genera *Brunsfelsia* and *Solandra* it is excessive in amount, the lobes wholly enveloping one another in

succession. I proceed now to add a few remarks upon each tribe separately.

1. *Nicotianeæ*.—The æstivation of the corolla in this tribe, as has been just remarked, is by no means valvate, or induplicato-valvate, as in the *Solanaceæ*, the lobes of its border being on the contrary conduplicate, that is to say, the sides are turned inwards, and each lobe is thus folded separately on its inner face, along the central nervure, the sides closely pressed together, the margins being quite free from those of the adjoining lobes, and thus plicated, they all possess a spirally twisted inclination in the bud. This approaches the æstivation of the *Salpiglossideæ*, to which tribe they offer a still nearer affinity in having the fifth stamen very often shorter, with the other four somewhat didynamous. It is for these reasons that I have removed the *Nicotianeæ* from the *Solanaceæ*, where I formerly placed them.

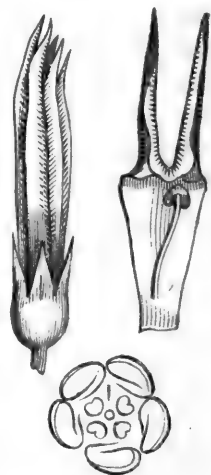
2. *Datureæ*.—With this very natural group *Solandra* has been associated by most botanists, but it evidently possesses a very different relationship. The *Datureæ* are remarkable for their large showy flowers, and they all present an æstivation similar to that of the *Nicotianeæ*, only more decidedly contortive and quite distinct from the valvate præfloration of the *Solanaceæ*. *Brugmansia* I consider as most decidedly distinct generically from *Datura*, with which it is associated by most botanists, differing in many points of structure, and forming arborescent shrubs, sometimes even tall trees, with long pendent trumpet-shaped flowers of an unusually large size.

3. *Duboisieæ*.—The genera composing this very distinct group were partly included by Mr. Bentham (Prodr. DeCand. x. 191) in his *Salpiglossideæ*; these are *Duboisia* and *Anthocercis*, to which Prof. Endlicher added *Anthotroche*, a genus which by the former has been referred to *Solanaceæ*. In proposing to alter the decisions of so distinguished a botanist as Mr. Bentham, who, from the accuracy of his observations and the solidity of his conclusions, stands deservedly as one of the first botanists of our time, it becomes necessary that I should offer some extremely valid reasons for the changes now suggested, and accordingly I will offer a few remarks on each genus in succession.

a. *Duboisia* appears to me to have no relation with any genus belonging to the *Scrophulariaceæ*. Its only species was originally described by Mr. Brown in his 'Prodr.' p. 448, who placed it, together with *Anthocercis*, in a second section of *Solanææ*. The habit of this plant, as well as the structure of its flowers, are there stated to agree with those of *Myoporum*, whence it derived its specific name: the figure given of this plant by Endlicher in his 'Iconographia,' pl. 77, sufficiently agrees with other *Myoporaceæ* plants there designed. On examining a specimen of

the same plant in Sir Wm. Hooker's herbarium, I noticed one very important character that has been quite overlooked by all preceding observers: the anthers are here decidedly extrorse, instead of the usual introrse direction before assigned to them. This circumstance brings *Duboisia* in close connexion with the two following genera, and at once removes them from the tribe of the *Salpiglossideæ*.

β. *Anthocercis*.—I was glad to avail myself of the opportunity of investigating the structure of the flowers in this genus from a plant in the living state of *A. viscosa*. It agrees with the figure given by Endlicher in his 'Iconographia,' tab. 68, of *A. littorea*, with the exception of the very important feature of the structure of the anthers, which, as in the preceding genus, offer the very distinct peculiarity of being affixed extrorsely just above the sinus upon the filament, so that the lines of dehiscence are towards the tube of the corolla, not introrsely towards the centre of the flower, as appears represented in the plate above referred to. The æstivation of the corolla in *Anthocercis viscosa* is also very peculiar: at first sight it would be said to be induplicato-valvate, but upon more careful examination it will be observed that each lobe of the border is distinctly supervolute, one of its edges being rolled inwards and overlapped by its opposite edge; these are not all turned in one direction, two being dextrorsely, and the other three coiled up alternately in a sinistrorse order. This mode of æstivation is certainly extremely unusual and peculiar, approaching that observed in the *Goodeniaceæ*, on which on a former occasion (Lond. Journ. Bot. vii. p. 59) I have made some observations. There exists between them this difference, that here each lobe is longitudinally and supervolately coiled round upon itself, in a somewhat spiral form, while in *Goodenia* the winged margins are respectively folded back over one another, upon the plane of the central portion of each segment. I have also examined in the dried state the flowers of *A. littorea*, *A. albicans*, *A. Tasmanica* and *A. scabrella*, and they all appear to offer the same kind of æstivation and similarly extrorse anthers, so that these appear to be constant characters. It is worthy of remark, that the peculiar smell of the leaves and flowers of *Anthocercis viscosa* resembles that of the *Myoporaceæ*, and that its pedicels are bibracteate, which is also a feature in that family; but its extra-axillary peduncles, the æstivation of its corolla, the position of its stamens, its bilocular ovary with numerous ovules attached to a thick-



ened placentiferous dissepiment, its many-seeded capsular fruit, and its slightly curved embryo with an inferior radicle, are characters quite opposed to its admission into that family. Nor can these be made to harmonize either with the *Scrophulariaceæ* or *Solanaceæ*, to the latter of which they offer a nearer affinity. These characters are sufficiently prominent and distinct, and demand a more attentive investigation.

γ. *Anthotroche*.—This genus was placed by Prof. Endlicher in *Scrophulariaceæ*, among the *Salpiglossideæ*, but it has been since excluded from the order by Mr. Bentham, and referred to *Solanaceæ* (DeCand. Prodr. x. p. 586). It appears to me however to have as little relation with the one as with the other of these families. Upon examining a specimen belonging to this genus from Swan River, I find that in the structure of its anthers it agrees entirely with that just described as existing in *Duboisia*; this consists of one reniform unilocular cell, fixed extrorsely on the filament, and dehiscing on the exterior face by one hippocrepical suture. Here the tube of the corolla is short and straight, and the border is divided into five regular lobes, which are rotately expanded; the stamens are 5 and equal. The ovarium has an epigynous prominent stylobasic gland as in *Cacabus*, analogous to that of *Hyoscyamus*.

Respecting the *Duboisieæ* it only remains to be observed, that the main points of distinction between it and the other tribes with which it is here associated, will be found to exist in the extrorse direction of the anthers and the singular æstivation of the corolla, peculiarities which, although very remarkable, are not of themselves of sufficient importance to claim for the plants that compose it the rank of a separate family, but they constitute a very distinct tribe of the *Atropaceæ*. It will consist of two sections: 1. *Euduboisieæ*, with baccate fruit, and 2. *Anthotrocheæ*, with capsular fruit, comprising *Anthocercis* and *Anthotroche*. It corresponds with the other tribes of the *Atropaceæ* in the origin of the floral peduncles being lateral with respect to the point of insertion of the petiole.

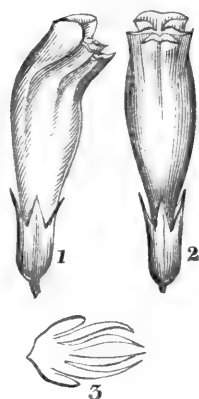
4. *Schizanthææ*.—The genus *Schizanthus*, from the lateral extra-axillary insertion of its pedicels and other characters, appears evidently to belong to the *Atropaceæ* rather than to the *Scrophulariaceæ*, but it does not accord with any of the tribes above noticed. It differs from them in the structure of its anthers, which consist of two parallel cells, quite distinct and separated from one another, but conjoined by a broad membranaceous connective, upon which they are dorsally attached: it possesses five stamens, of which three are quite anantherous and rudimental; the corolla is deeply cleft into numerous unequal segments which have an imbricate æstivation. Its stigma approaches the form

of that of *Heteranthia*: its fruit is capsular as in the *Salpiglossideæ*, and its seeds contain a terete embryo, curved in an almost spiral form. Its leaves are always alternate and deeply pinnatisected, showing an approach to *Salpiglossis* and *Pteroglossis*. The abortion of three of its stamens is an irregularity of which we find a parallel case in *Ianthe*, which only differs in that respect from *Verbascum*; and the deeply lacinated divisions of its corolla is another abnormal feature, but this may be considered only as a separation of the lobes of the corolla at each sinus, or a return to its five normal divisions, with a still farther cleavage of each lobe, by an extension in an excessive degree of the incisions commenced in the emarginatures of all the lobes of the border in *Salpiglossis*, which thus shows a tendency towards the lacinated form of the corolla of *Schizanthus*.

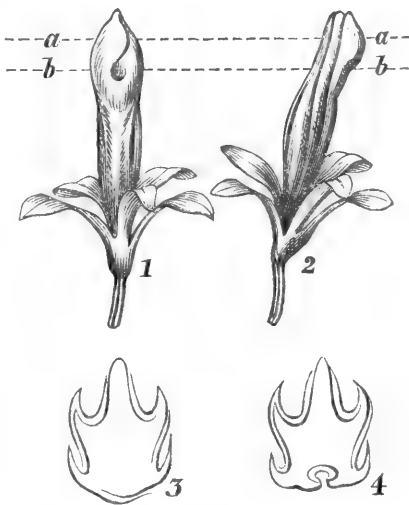
5. *Salpiglossideæ*.—I have ventured to remove this tribe wholly from the *Scrophulariaceæ* for the reasons that will be here fully explained, and as these are founded upon facts in great measure new, I may confidently expect that such an arrangement will meet with the concurrence of the author of the able monograph of this last-mentioned family, who in detailing the characters of the tribe in question, as given in the Prodr. DeCand. x. p. 190, goes the length of saying, “subordo Solanaceis capsularibus arcte affinis, et forte melius eis adsociandus.” I propose however to remove from it several of the genera there associated. They form an extremely natural group, distinguished by the very peculiar æstivation of their corolla, their didynamous stamens, or where a fifth occurs it is invariably sterile, and they are especially conspicuous for the remarkable dilatation of the stigma, which at once signalizes them from the others. Their place is manifestly among the *Atropaceæ*, with which they agree in having the origin of the pedicels always somewhat lateral in regard to the floral leaflet or bract, not decidedly axillary, as in the *Scrophulariaceæ*. They are all herbaceous plants, generally clothed with viscid glandular pubescence, and the campanular portion of the tube of the corolla is plicated in æstivation; but the lobes of its border are first conduplicate, with the margins always free from those of the contiguous lobes, and twisted inwards in a peculiar manner, for which I have proposed the term *reciprocativæ**, a condition intermediate between the induplicato-valvate æstivation of the *Solanaceæ* and the imbricate præfloration of the *Scrophulariaceæ*; in order to render this more evident, the accompanying

* It may be thus defined: *Æstivatio reciprocativa*, i. e. lobi superioris exterioris marginibus utrinque induplicatis, lorum alterorum simpliciter conduplicatis, 2 sinistralibus dextrorsim, 2 dextralibus sinistrorsim torsive convolutis, marginibus sese applicitis et a contiguis liberis postice spectantibus, plicaturis antice inclinantibus.

figure is given in the margin; fig. 1 being the corolla viewed sideways; fig. 2, ditto seen in front; fig. 3, ditto seen from above. I have added to this group a new genus, *Pteroglossis*, founded upon a plant collected in the north of Chile by Bridges (his No. 1389). In *Salpiglossis* the two broadly expanded lips of the stigma appear almost confluent into a tongue-shaped process, while in the other genera they are more or less distinctly separated and 2-lipped, especially in *Leptoglossis* and *Browallia*; but in *Pteroglossis* one of the lips appears altogether wanting, or reduced to a small prominent gland.



6. *Petuniæ*.—The genera which I have separated from the *Solanaceæ* to form this tribe, approach the *Salpiglossideæ* most closely in habit and in the general structure of their flowers and seeds, and moreover partake of their peculiar feature, the great dilatation of their stigma: the broadly expanded lips of this organ appear however more or less soldered into a tongue-shaped process, as in *Salpiglossis*, which singularly embraces the connate anthers in *Nierembergia**. They differ notwithstanding from the *Salpiglossideæ* in the peculiar complex æstivation of their corolla: that of *Nierembergia*, being figured in plate 18 A. fig. 2 of the 'Illustration of South Amer. Plants,' will require no further explanation: the figure of that of *Petunia* was omitted in plate 23 of that work, and its description was most obscurely given in 'Lond. Journ. Bot.' v. p. 18 (in a note), owing to several omissions and transposals of words in the hurry of the last moment of the monthly publication of that journal. In order to remedy this omission, a delineation of the æstivation † of



Petunia violacea is now given in the margin; fig. 1 being the corolla seen in front; fig. 2, the same viewed sideways; fig. 3, a transverse section made across the line *a a*; fig. 4, ditto ditto across *b b*.

* See Ill. South Amer. Plants, pl. 18. A. fig. 4, B. fig. 5, and pl. 20. fig. 3.

† It may be thus more simply defined: Æstivatio replicativa, i. e. lobis omnibus subconduplicatis, superioris interioris marginibus revolutis, alterorum plicaturis postice torsis, marginibus cum contiguis quincuncialiter late imbricatis, margine altero hinc revolutis.

7. *Hyoscyameæ*.—This forms a very natural tribe, remarkable for the very singular epigynous gland, hitherto I believe new in the history of vegetable physiology, the origin and nature of which it is desirable to ascertain. It cannot bear any analogy with the true disc, which is always hypogynous in the superior ovary and epigynous in the inferior germen, and which is generally admitted by botanists to be little more than a confluent whorl of abortive stamens. In *Cacabus* it assumes the form of an enlargement of the base of the style, but that it exists here as a distinct organ is proved by the swelling seen within the matured fruit, in the summit of the cavity of the cells. In *Thinogeton* it is considerably larger, where it appears as a coriaceous thickening of the chartaceous covering that forms the upper portion of its dry berry. It is however most distinctly developed in *Hyoscyamus*, even in the young ovary, in the form of a fleshy external gland, which covers more than the superior moiety of the entire germen, and on making a longitudinal section it is seen distinctly adnate upon the true endocarpium: it forms therefore a very good discriminating character of this tribe. The cause of the opercular dehiscence of the fruit in *Hyoscyamus* is thus readily accounted for, because while the lower half of the pericarpial covering remains thin and membranaceous, the opercular portion becomes hard and coriaceous, from the indurescence of the glandular covering above-mentioned*. I have placed doubtfully in

* Although in the above case it is easy to trace the cause of the opercular dehiscence of the fruit, the same is not so readily accounted for in other cases; in *Anagallis* for example. In this last-mentioned instance, a distinct zonal line may be seen in the thin pericarpial covering before the ripening of the fruit, and it is along this that the membranaceous capsule afterwards bursts, by a clean circumscissure. This zonal line however bears no relation to the longitudinal true nervures, which may be distinctly traced in the pericarpial covering, and which, extending from the style to the base, may be referred to the midribs and marginal junctions of the original carpellary leaves: but what is the nature of the line which traverses these nervures at right angles across all the carpellary leaves? This is difficult to be accounted for, unless we imagine it to arise from a cause somewhat analogous to the case of *Hyoscyamus*, only that instead of the line being the marginal limit of an epigynous gland, it may be the edge of an original elementary hypogynous disc, which by its subsequent growth and attenuation becomes hardly distinguishable from the rest of the pericarpium. On examining this pericarpial covering, about the period of the fall of the corolla, this zonal line is seen more transparent than the rest of its substance, and not opaque, as is observable in the regular longitudinal nervures which may then be readily traced; at this period however, and even in the younger state of the ovary, before this zonal line becomes distinguishable, the lower half of the pericarpial membrane is decidedly of a more greenish hue than the upper moiety. This appears to me the only theory on which we can account for the dehiscence of the capsule in *Anagallis*, but in suggesting it, I confess that I could not discern the fact of the original existence and ultimate attenuation of such a disc as I have imagined. Although, generally speaking,

this tribe, *Scopolia*, *Physoclena*, *Thinogeton* and *Cacabus*, genera which offer a striking affinity to one another in their most essential characters, and there can be little doubt that they all form a portion of one very distinct group. These characters coincide for the most part with those of *Hyoscyamus*, and the only consideration wanting to complete their affinity is the æstivation of their corolla. The funnel-shaped and almost entire border of the corolla in those genera would almost necessarily imply the regular plicature of its campanular portion, but it is probable that at the same time the lobes in æstivation may be somewhat imbricate, as is distinctly observable in *Nierembergia* and *Petunia*. It is impossible to determine this question from dried specimens, and it can only be ascertained from the examination of living plants. Should the æstivation be found, on the contrary, to be entirely induplicato-valvate, these four genera would not belong to *Atropaceæ*, but must be referred to *Solanaceæ*, where they would naturally find their place as a capsular tribe preceding the *Jaboroseæ*.

8. *Atropææ*.—This very distinct group is distinguishable from the other tribes by its baccate fruit, and its ovary devoid of a fleshy epigynous gland. The first four genera possess a perennial root, with numerous deciduous herbaceous stems, large showy flowers, and a somewhat shrubby habit, with dense foliage and large leaves. *Lycium*, on the contrary, is a straggling shrub with woody stems, and frequently with spinous branches: its flowers are small. These differences are only generic, and do not offer sufficient reasons for separating the latter genus as a tribe distinct from the others.

no apparent hypogynous disc is to be seen among the *Primulaceæ*, it is occasionally discernible, but I believe only in those genera where the capsule bursts into valves by the longitudinal carpellary nervures, as in *Lysimachia*, of which genus Nees v. Esenb. in his 'Gen. Pl. Fl. Germ.' says distinctly, "Germen liberum basi disco annuliformi cinctum." This view of the case, though quite hypothetical, is rendered still more probable by the facts observable in the capsule of *Plantago*, which offers a membranaceous pyxidium very similar to that of *Anagallis*. At an early period the future transverse line of dehiscence is discernible in the ovarium, as in *Anagallis*, but it is then more approximate to the base, proving that the growth of its lower portion is afterwards more considerable than the upper part; as it advances towards maturity the zonal line becomes more marked, the upper portion of the pericarpial covering being of a deeper green hue and more opaque, while the lower moiety is distinctly hyaline and transparent, and of more slender texture; on becoming ripe, the greater indurescence of the upper half, by desiccation, is still more evident, facts which lead to the only reasonable conclusion, that the upper portion of the ovarium is covered by a very thin epigynous glandular covering, as in *Hyoscyamus*, but too thin to be readily detected in parts of such very slender texture: that it does exist, is however proved by the circumstance of that part of the pericarpial covering being always less pervious to light, when viewed under the microscope, than the lower moiety.

9. *Solandrea*.—These form a very natural group, being all suffruticose, mostly subscandent plants, with large leaves and generally showy flowers. I have been enabled to obtain very satisfactory elements of the little-known genera *Juanulloa* and *Marckea*, besides those of two new genera. They bear a somewhat similar position among the *Atropaceæ* that the *Metternichieæ* hold among the *Solanaceæ*, and the analogy in the structure of the seeds of *Marckea* and *Metternichia* is sufficiently remarkable.

10. *Brunsfelsiæ*.—This group, consisting of some of the plants placed by Mr. Bentham in his *Salpiglossideæ*, is distinguishable from that tribe as above limited by the absence of the remarkable dilatation of the stigma: it will comprise the genera *Brunsfelsia*, *Franciscea* and *Heteranthia*: the latter much resembles *Browallia* in its habit, but it accords with the two former genera in the structure of its anthers, which are unilocular, and curved in the shape of a horseshoe round a fleshy globular connective, that in great part enters into and nearly fills the cavity of the cell, as in the *Verbasceæ*. I have here considered *Franciscea* as distinct from *Brunsfelsia*, which Mr. Bentham (in DeCand. Prodr. x. p. 198) combined together under one genus. In *Brunsfelsia* however the corolla is always of a yellowish colour, the tube is considerably longer and narrower in proportion, and the fruit consists of a large fleshy drupe inclosing a putamen which is quite indehiscent. In *Franciscea* the flowers are always of a purplish or violet colour, with a much shorter tube and an oblique rotate border: the fruit is generally capsular, and rarely somewhat baccate; but when this occurs, I have noticed in the dried specimens, that as the fleshy sarcocarp covering the putamen dries into the form of a coriaceous integument, both split into four divisions at the apex, in a valvular form, as in the capsular species. In *Brunsfelsia* the style is very long and slender, quite erect at the apex, and terminated by a small clavate stigma which is bilobed, its equal concave lobes being filled with a ball of grumous matter. In *Franciscea* the style is considerably enlarged and incurved at its summit, which is terminated by a much larger bilobed gaping stigma, the lower lobe being somewhat smaller, and it exhibits in its sinus a globe of viscous matter, seen only in the living state. In *Heteranthia* the style is far exserted, and is terminated at its slender and somewhat incurved apex by an almost obsolete fistulose stigma. The species of *Brunsfelsia* attain the size of large trees, 20 feet in height, while on the contrary those of *Franciscea* do not exceed the size of bushes, which are seldom more than 3 or 4 feet high. *Heteranthia*, on the other hand, is a small repent perennial plant, with short ascending branches, terminated by a racemose inflorescence.

Having now reviewed in succession the different genera composing the *Salpiglossideæ* of Bentham, with the exception of *Schwenkia*, it is necessary to offer a few words upon that genus, the true affinity of which for many years puzzled the sagacity of botanists.

Linnaeus had the penetration first to point out its affinity with the *Solaneæ*, an opinion which has been since quite disregarded. It was afterwards considered as belonging to *Primulaceæ*, on account of the insertion of its stamens opposite to the lobes of the corolla. By Nees v. Esenbeck and Martius it was subsequently referred to *Scrophulariaceæ* (Nov. Act. xi. p. 47); but a note was added by Martius pointing out the greater probability of its affinity to *Acanthaceæ*, because of the fissure of the apex of the dissepiment, a character which I have not observed in the genus. This indication has not been adopted by others, certainly not by Nees, who in his monograph on this last-mentioned family (DeCand. Prodr. vol. xi.) does not allude in any way to *Schwenkia* in relation to it. Mr. Bentham was the first to explain the apparent anomaly of the position of the stamens in regard to the lobes of the corolla, and to demonstrate that the intermediate glands seen in most of the species constituted the true normal lobes of the border, and that the stamens were consequently alternate, and not opposite to its lobes. It was therefore placed by that able botanist next *Browallia*, a position that appears to me hardly satisfactory, on account of the valvate æstivation of the lobes of its corolla, and because its anthers consist of two distinct cells fixed on the apex of a dilated membranaceous filament. For these reasons, I would suggest its nearer affinity to *Fabiana*, with which it possesses many characters in common: the cristate projection of the placentæ from the middle of the dissepiment, and the insertion of the ovules in distinct linear series as described by Martius (*loc. cit.*), quite correspond with the figure I have given of the placentation of *Fabiana* (Ill. S. Am. Pl. tab. 17). *Schwenkia* however is a genus that requires more careful examination.

Having thus indicated those genera which I propose to separate from the *Solanaceæ*, it is desirable to exhibit the arrangement of the remainder that will hence constitute that family. There is a considerable alteration in the view now offered, from that given on a former occasion, as since that time most of the genera have been more attentively examined, and their characters more accurately ascertained. I intend therefore in the sequel to present a description of the outlines, all now completed, of such of the genera as have not yet been delineated, enumerating at the same time the several species composing them (with the exception of those of *Solanum*, *Capsicum*, *Physalis* and a few others),

to which will be subjoined a review of the several new genera that have presented themselves in the course of this inquiry. To these details will be added the description of such of the genera of the *Atropaceæ* as have not yet been described by me, and the whole will offer a large accumulation of novel facts, that probably may serve to facilitate the labours of the able botanist now engaged in a monograph of this large family, which has hitherto been so little studied.

In these investigations I have been carried far beyond the line originally intended, having been tempted to proceed by the abundant materials that have presented themselves to my notice, principally derived from the rich herbarium of Sir Wm. Hooker, to whose kind liberality I am mainly indebted for the opportunity of bringing to light so large an accumulation of new facts. The following synopsis will be sufficient to exhibit the proposed arrangement without farther explanations.

SOLANACEÆ.

TriBUS 1. METTERNICHIEÆ (char. Lond. Journ. Bot. v. 148). Fructus capsularis, embryo teres, rectus

1. *Metternichia*.2. *Sessea*.

TriBUS 2. CESTRINEÆ (char. *loc. cit.*). *Id. id.*...

3. *Cestrum*.

TriBUS 3. FABIANEÆ (char. *loc. cit.*). Fructus capsularis, embryo paullulo incurvatus, fere rectus

4. *Fabiana*.5. *Vestia*.6. *Schwenkia*?

TriBUS 4. JABOROSEÆ. Corolla tubo elongato siccatione nigrescens: fructus baccatus 2-locularis, embryo teres, fere annularis . . .

7. *Jaborosa*.8. *Dorystigma*.9. *Himeranthus*.10. *Trechonætes*.11. *Salpichroma*.12. *Nectouxia*.

TriBUS 5. IOCHROMEÆ. Corolla tubo elongato, limbo 5-fido plus duplo longiore: antheræ longitudinaliter dehiscentes: calyx fructiferus vix auctus baccam 2-locularem suffulciens vel arcte cingens: embryo teres, fere annularis

13. *Iochroma*.14. *Cleochroma*.15. *Lycioplesium*.16. *Pæcilochroma*.17. *Hebecladus*.18. *Dunalia*.19. *Acnistus*.20. *Phrodus*.

Tribus 6. *PHYSALEÆ*. Corolla tubo brevi, limbo campanulato 5-angulato vel 5-partito : antheræ longitudinaliter dehiscentes : calyx fructiferus valde auctus et vesicarius : fructus baccatus, embryo teres, fere annularis. .

21. *Physalis*.
22. *Larnax*.
23. *Margaranthus*.
24. *Withania*.
25. *Hypnoticum*.

Tribus 7. *WITHERINGEÆ*. Corolla tubo brevi, limbo 5-fido vix excedente : antheræ longitudinaliter dehiscentes : calyx fructiferus vix auctus, baccam 2-locularem suffulciens, vel eam arcte vestiens : embryo teres, spiraliter curvatus

26. *Witheringia*.
27. *Capsicum*.
28. *Brachistus*.
29. *Saracha*.
30. *Discopodium*.
31. *Puneera*.
32. *Aureliana*.
33. *Sichlera*.

Tribus 8. *SOLANEÆ*. Antheræ apice 2-porosæ, vel in tubum connatæ, intus dehiscentes : fructus baccatus, 2- raro pluri-ocularis : embryo teres, spiraliter arcuatus

34. *Solanum*.
35. *Cyphomandra*.
36. *Triguera*.
37. *Lycopersicum*.

VERBASCEÆ.—The suggestions of our learned countryman offered in his ‘Prodr. Fl. Nov. Holl.’ which I have cited in a former page (in a note, *ante*, p. 162), were evidently intended, in the state of our knowledge at that time, to apply principally to the *Verbasceæ*, which by Jussieu, Linnæus, and other eminent botanists had been classed among the *Solaneæ*. Bartling afterwards was the first to arrange the *Verbasceæ* as a distinct tribe among the *Scrophulariaceæ*, and Nees v. Esenbeck, acting upon the suggestion of Mr. Brown, proposed the *Verbascinæ* as a distinct family, intermediate between *Solaneæ* and *Scrophularinæ* (Trans. Linn. Soc. xvii. p. 78). The principal reasons that have induced all subsequent botanists to adopt the suggestion of Bartling, have been the imbricate æstivation of the corolla, and the frequent suppression of some of the stamens, which have been considered paramount to the many other not less important considerations that tended to show the near approximation of the *Verbasceæ* to the *Solaneæ*; but these objections, fatal as they were to the admission of this tribe into the latter family, do not apply to their connexion with the *Atropaceæ*,

with which group they exhibit beyond all doubt a very close alliance. This is manifest in their general habit, their alternate leaves with glutinous pubescence, their fetid smell, their powerfully narcotic and other medicinal qualities, which are so characteristic of the *Solanaceæ* and *Atropaceæ*: to these may be added the particular structure of their stamens, which have their anthers of a somewhat lunar form, and quite unilocular, curved round a large clavate termination of the filament, with an almost globular expansion of their connective, within the cell, that serves as the polliniferous receptacle, a character pointed out by Nees as being foreign to the *Solaneæ* and rare among the *Scrophularinæ*, and as claiming for them a distinct station in the system. On the other hand it should be borne in mind, that this peculiar character exists also in the genus *Scrophularia* itself, the flowers of which exhibit often declinate anthers and barbate filaments, together with a fifth sterile stamen, a feature rare in the *Scrophulariaceæ*, and one that tends to show a very close connexion of this genus with the *Verbasceæ*, with which tribe it had been before associated by all preceding botanists, until Mr. Bentham, in his admirable monograph of the order, has placed it among the *Cheloneæ* (DeCand. Prodr. x. 299). In most of the genera of this last-mentioned tribe, the anthers are formed constantly, I believe, of two distinct and divaricate cells, affixed at their apex on the slender summit of the filament, and quite wanting of the fleshy connective so manifest in *Scrophularia* and the *Verbasceæ*. Whatever may be determined in regard to the proper place of the *Verbasceæ* in the system, it is manifest that it is not by the number of the stamens that we can fix the limit between the *Atropaceæ* and *Scrophulariaceæ*: thus it is impossible to separate *Celsia* from *Verbascum*, and it would be equally as admissible to include *Celsia* with its didynamous stamens, or *Ianthe* with its single pair, in *Atropaceæ*, as it is to place *Verbascum*, with its regular pentandrous flowers, in *Scrophulariaceæ*: such discrepancies cannot fail to occur in many solitary points of osculation between the genera of different tribes, in all our artificial modes of the classification of plants. We have also other instances not less strikingly contrary to the ordinary rule in the *Xuaresia biflora* of the 'Flora Peruviana,' which has a regular 5-partite corolla and 5 alternate equal stamens: this plant Mr. Bentham unhesitatingly considers to be a true species of *Capraria*, a genus decidedly *Scrophulariaceous*; and in like manner the *Bacopa* of Aublet with its 5 equal stamens offers another exception, but here the plant has opposite leaves, and possesses so precisely the habit and general features of *Herpestes*, that its position must without doubt be fixed contiguous to that genus. The same rule will apply to another anomalous case instanced by Mr. Bentham

in the genus *Campylanthus*, the seeds of which have a perispherically-curved embryo, a character that by itself would place it in *Atropaceæ*; but that distinguished botanist fixes its position among *Scrophulariaceæ*, on account of the form of its corolla and of its anthers, notwithstanding, as he observes, that it bears little analogy with any other genus contiguous to it. The principal reason however that appears to me to give the *Verbasceæ* the preference of a place among the *Scrophulariaceæ* is the truly axillary origin of the floral peduncles, a character that in all such doubtful cases may be employed as a decisive line of demarcation between that order and the *Atropaceæ*. The position of the *Verbasceæ* should then appear at the head of the *Scrophulariaceæ*, occupying the place of a suborder in the manner of the *Salpiglossideæ* of Bentham (DeCand. Prodr. x. p. 190), where they would serve as a connecting link of the closest affinity between these two families.

RETZIA.—This anomalous genus* has never yet found a certain or satisfactory place in the system, and its position must remain problematical until the structure of its fruit and seed be more accurately investigated. By many botanists it has been placed in *Convolvulaceæ*; others have indicated its relation to *Apocynæ*; some have again referred it to *Polemoniaceæ*, with which it certainly offers no affinity; and Bartling proposed for it a new natural order, under the name of *Retziaceæ*, but this stands upon too insufficient grounds. Endlicher places *Retziaceæ* as a doubtful order after *Solanaceæ*, and Dr. Lindley arranges the genus *Retzia* among *Solanaceæ*, after *Sesseea*. In the form of its calyx and of its corolla, the number and position of its stamens, its bilocular ovary with placentæ attached to the dissepiment, the structure of its capsule and of its seeds as far as they are known, offer characters strictly conformable with those of *Solanaceæ*; but it would now rather fall among the *Atropaceæ*, on account of the æstivation of its corolla, which is said by Endlicher and Lindley to be imbricate, and not valvate: the form of its embryo, which on the authority of Brown (Prodr. 482) is terete and straight, necessarily, if it were admitted into this family, would point to its situation as a tribe near the *Solandreæ*.

Thus far every feature appears in conformity with such an ar-

* **RETZIA**, *Thunb.* Calyx tubular, 5-fid, lobes lanceolate, somewhat unequal. Corolla tubular, elongated, straight, tube in no degree plicated, border of 5 short equal lobes imbricated in æstivation. Stamens 5, equal, nearly sessile in mouth of tube, alternate with its lobes, filaments extremely short. Anthers oblong, cordate, 2-celled, cells parallel, bursting longitudinally in front. Ovary oblong, seated on a fleshy gland, 2-locular, ovules upon placentæ adnate to the dissepiment? Style longer than corolla, filiform. Stigma very short, bifid, with divaricate linear segments. Capsule bisulcate, bilocular, bivalved. Seeds several. Embryo straight, terete.

rangement, but one objection presents itself which renders this conclusion somewhat unsatisfactory, and that is the peculiar habit of the only well-recognized species, *Retzia spicata*, which is different from that of any *Solanaceous* or *Atropaceous* plant. Here the leaves are verticillate in fours, and the flowers are solitary and sessile in each axil, being supported by two bracts similar in size and shape to the lobes of the calyx. The genus *Solenostigma* of Klotzsch, founded upon one of Zeyher's African plants, and supposed to be identical with *Retzia*, was placed by that botanist in *Stilbaceæ*; but the name would imply that the stigma is there hollow and tubular, while in *Retzia* it consists of two small linear divaricate segments; hence it is probable that Klotzsch's plant is very different from that of Thunberg. I may here observe however, that this fact does not of itself invalidate their mutual affinity, for in the vast genus *Solanum* we meet with different species, some with a hollow tubular stigma, and others with bifid linear segments, exactly similar to the stigma of *Retzia*. The *Polemonium campanuloides* and *P. roelloides* of Thunberg have been referred to *Retzia* by Sprengel, G. Don and Dr. Walpers; these plants have both alternate leaves, and if really species of that genus, they would tend to remove the doubts above expressed in regard to the place of *Retzia* in this natural order. Willdenow states (Syst. i. 887) that the two species last alluded to, cannot belong to *Polemonium*, which has a trifid stigma; and he adds, that *P. campanuloides* has a bifid stigma as in *Retzia*. The *Convolvulus ænotheroides* (Linn. fil.) is also said to be another species of this genus. The only facts wanting to confirm its place in the system are the position of its ovules and the structure of its seeds. Dr. Lindley, who has examined its ovarium, has observed that its ovules are very few, two (or four?) in each cell, articulated with and suspended from the dissepiment by a large thickened funiculus, a character not at all conformable with the *Atropaceæ* or *Solanaceæ*, and one that would seem to remove this genus nearer to the *Bruniaceæ*, with which *Retzia* will be found to possess many similar characters. For the present therefore we must hesitate in attaching *Retzia* to the *Atropaceæ*.

The genus *Lonchostoma* of Wikström, placed by most botanists in *Retziaceæ*, offers, I find, many characters in common with *Bruniaceæ*: its sepals are united at the base by a membranaceous tube which closely invests the ovarium, if not almost adnate with it; they are surrounded by bracts of equal size: it resembles *Gravenhorstia* in having its petals combined into a funnel-shaped tube with a 5-partite border, the lobes of which are carinate and convolutely imbricate in æstivation; the anthers, cordate at base, are nearly sessile in the mouth; the style is divided halfway down and terminated by clavate stigmata; the ovarium, 2-celled, appears

under the microscope to be composed of two distinct, though connate carpels; the ovules are few, horizontally attached, or somewhat pendulous from narrow axile placentæ attached to the twofold dissepiment. These are characters that seem to correspond in great measure with the *Bruniaceæ*, with which the habit of *Lonchostoma* does not ill accord. These are merely hasty indications, as it would be foreign to the object of the present investigation to pursue such inquiries farther.

XIX.—*On the Anatomy of Eolis, a genus of Mollusks of the order Nudibranchiata.* By ALBANY HANCOCK and DENNIS EMBLETON, M.D.

[Continued from vol. i. 2nd Series, p. 105.]

[With two Plates.]

Nervous System.

THIS is made up of central masses or ganglia united by commissures, and of nerves. The ganglia are five or six pairs, four of which are symmetrically arranged with regard to the median line, and together with their commissures surround the commencement of the œsophagus lying upon the upper and posterior surface of the buccal mass, vol. xv. Pl. V. fig. 16 *b* and Pl. V. fig. 1 of present paper. Two pairs are supra-œsophageal and two infra-œsophageal. The former exceed the latter many times in size. The masses are of a pale yellowish flesh-colour, and appear to be filled with globular vesicles of various sizes.

First, of the supra-œsophageal or cerebral ganglia, the median pair, Pl. V. fig. 1 *a a*, largest of all, are irregularly ovate, flattened above and below, and somewhat constricted about the middle as if composed of two parts; their anterior ends, which are the larger and truncated, are united across the median line by a short broad commissure. The second or lateral pair, *b b*, lie rather behind the first and on the sides of the œsophagus; they are irregularly spheroidal, smaller than the first and flattened like them, and intimately connected to their external posterior margin. The two pairs of infra-œsophageal ganglia are of very unequal size: the first or buccal, or larger pair, *c c*, are elliptical, their long diameters placed transversely one on each side of the median line, across which a short thick commissure unites their contiguous ends; from the under surface of these, at their outer and anterior part, spring two short pedicles, supporting the second pair of ganglia, *d d*, the gastro-œsophageal, very small, not one-fourth the size of the last, but of the same form. In

addition to these, there is a pair of ganglia, *ee*, at the base of the dorsal tentacles, which we call olfactory; and we have seen what we take to be other ganglia, but of these we shall speak further on.

The nervous centres intercommunicate by the following commissures. A short broad one, *f*, unites the first pair of supra-oesophageal, and a similar though smaller, *g*, the first pair of infra-oesophageal; these have been already noticed; then the lateral supra-oesophageal are united to the first or anterior or cerebral by a broad flat band, *h*, so short that the ganglia appear to be continuous with each other. Next we have three nervous bands or collars, concentrically arranged, inclosing the oesophagus, and serving to complete the connexions of the supra-oesophageal ganglia with each other, and to bring them into association with the infra-oesophageal. First, the innermost or thickest collar, *i*, lies close to the oesophageal wall, and is composed of four or five distinct nervous filaments running parallel to each other, and connecting together the posterior borders of the two lateral supra-oesophageal masses. Second, a slender, delicate collar, *j*, lies next outside, much wider than the former, and uniting the posterior and outer parts of the first pair of supra-oesophageal ganglia, it comes out from the under surface of these bodies and runs under the second or lateral ganglia. The existence of this collar or commissure between the posterior parts of the median cerebral ganglia, whilst their anterior parts are united by the anterior median commissure, seems to confirm the impression we received at first sight, that the cerebral ganglia are each of them double centres. It will be observed that the two last-described oesophageal collars are not attached in any way to the infra-oesophageal ganglia. The third or outermost collar, *k*, however establishes a communication between the first or median supra-oesophageal and the first infra-oesophageal ganglia. This is a strong band, being little inferior in size to the first, of uniform texture, and lying just outside of the second collar, and in contact with it, it is the widest of the three. In front it is attached to the under part of the outer border of the first cerebral ganglia, considerably in advance of the coming off of the second collar; from this part it is traced backwards under the lateral supra-oesophageal into the external end of the buccal ganglia.

The nerves vary a good deal in size, and we have been able to trace thirty-three pairs; of these, twenty-one come off from the supra-oesophageal ganglia, six from the infra-oesophageal, and five from the commissures. There is also a large pair which comes out from the buccal mass from an obscure ganglion imbedded in the muscular tissue, and a small nerve, apparently single, that separates from the middle collar of the oesophagus,

and seems to present a small ganglionic enlargement. We have numbered them in the order in which they occur, commencing at the median line in front.

The first and second pairs, very minute, come out of the under surface of the anterior commissure of the first or cerebral ganglia, and pass to the skin on each side of the median line before and behind the dorsal tentacles.

The third pair, large nerves, come out of the first cerebral ganglia at their upper surface, and near the middle of their anterior border; they pass forwards, upwards and downwards to the roots of the dorsal tentacles, within which each suddenly swells out into a remarkable ganglion, *e*, of an irregularly oval form, which, at its upper end, divides into three or four processes, each giving off nerves to be distributed for the supply of the whole tentacle. This pair we look upon as the special nerves of smelling, for reasons which will be adduced hereafter, and as endowing the tentacle with the power of ordinary sensation likewise. If this view be correct, then the small branches passing from the ganglion to the sentient surface of the tentacles are properly to be designated olfactory nerves, and the thick pedicle supporting the ganglion and connecting it with the cerebral ganglion, olfactory tractus.

The fourth and fifth pairs, considerably less than the third, arise also from the anterior part but under surface of the same ganglia, close together, and just outside of the third. The fourth runs forward to the outer lip before giving off any branches; after that it divides and subdivides minutely, and goes to supply the outer lip above and below. The fifth runs forward and is distributed to the skin of the head and between the dorsal tentacles, but does not give off such numerous branches as the preceding nerve.

The sixth, one of the largest nerves in the body, comes out of the external anterior angle of the ganglion, and after a short course outwards and forwards bifurcates. The two branches are about equal in size: one passes into the oral tentacle, divides into two branches which subdivide and supply the tentacle; the other runs forward, and then inclines inwards towards the median line, and subdivides into many twigs which are distributed upon the roof of the channel of the mouth.

The seventh and eighth are minute nerves which issue from the outer margin of the ganglion just behind the sixth. They take a straight course outward and pass into the skin of the side of the head.

The ninth is a large pair, coming out of the same ganglion just behind the preceding, and running outwards and forwards gives off a twig which goes to the muscles attaching the buccal

mass to the skin. It then passes forwards and inwards, and is lost upon the sides of the channel of the mouth.

The tenth and eleventh pairs are small, come off from the same ganglion still further back and just in front of the eye, and pass directly outwards into the skin.

The twelfth and thirteenth arise from the junction of the anterior and lateral cerebral ganglia, and passing outwards and downwards first, then incline downwards and backwards and run half-way down the body, one above the other, in the skin between the border of the foot, and the rows of branchial papillæ.

The fourteenth and fifteenth, very minute pairs, emerge from the line of union of the anterior and the lateral ganglia, and are then placed directly under the eye. The former of these nerves goes to the skin of the side of the head between the oral and the dorsal tentacles, the latter to the skin immediately behind the situation of the former.

The sixteenth or optic nerves are stout but very short, and have the organ of vision at their extremity. They are inclined forwards and upwards from the line of union of the anterior and lateral ganglia.

The seventeenth or auditory are mere rudiments of nerves, and are attached to the anterior ganglia quite close to the bases of the optic nerves, and immediately behind them. The auditory capsule and the eye will be described further on with the other organs of special sense.

The eighteenth pair, one of the largest, issues from the outer borders of the lateral ganglia, rather in front of the middle, passes outward and bifurcates very soon after; each of these branches again bifurcates and is distributed by many twigs to the muscles and skin of the foot, both anteriorly and posteriorly (the pedial nerve).

The nineteenth, also of considerable size, come out of the external borders of the lateral ganglia, behind the middle, separated by a considerable interval from the eighteenth, and passing slightly outwards take a backward course, and can be traced in the skin for a long way down the sides of the back, giving off chiefly externally numerous branches that supply the skin. This we presume is the respiratory nerve.

The twentieth are seen to come forth from the posterior margins of the anterior ganglia, and are of a size little inferior to the last. They can be traced in the skin of the back between the last-described nerve and the dorsal median line nearly as far as the tail, giving off twigs from their outer sides like the nineteenth pair to the skin.

The twenty-first, twenty-second and twenty-third pairs are all small nerves coming out successively from the posterior borders

of the anterior ganglia between the last-described nerve and the median line. They all pass a good way backwards to the dorsal skin on each side of the median line.

The origin, course and distribution of the six pairs of infra-œsophageal nerves are as follows :—

The first pair come from the upper surface of the roots of the pedicles that support the gastro-œsophageal, and close to the buccal ganglia. The nerves are rather small, run forwards and apply themselves to the œsophagus, along which they are conducted to the stomach, the greater part of which organ they supply with branches.

The second, third and fourth arise from the margins of the gastro-œsophageal ganglia, are very small nerves, but can be traced to the œsophagus and neighbouring parts of the stomach.

The fifth pair come out of the external ends of the buccal ganglia in conjunction with the third or outermost œsophageal collar, to which they are slightly inferior in size. The nerves and the collar separate at once; the nerves passing backwards and outwards give off each a branch that bends forwards and outwards and becomes lost among the muscles of the buccal mass external to the ganglion. The trunk then inclines towards an opening between the muscular bundles of the back part of the buccal mass, and enters that opening lying in contact with another large nerve that is observed to issue from the same.

It is difficult to follow the trunk far into the intermuscular aperture, but as far as we have been able to trace it, it appears to be destined for the buccal mass and tongue.

The sixth pair is given off from the posterior margin of the buccal ganglia, and shortly after becomes lost among the muscular bundles of the back part of the buccal mass.

Of the five pairs of nerves from the commissures, two have already been described, viz. the first and second supra-œsophageal; the three that remain come off from the œsophageal collars in the following manner.

The pair marked α come off from the outer margin of the first or innermost collar near the median line. They are very minute nerves, and we have not succeeded in tracking them to their destination.

That marked β is the genital and probably the cardiac nerve, and is an offset from the middle or slender collar, which it nearly equals in size, at a short distance behind its attachment to the anterior cerebral ganglion. It runs from this origin backwards and outwards to the generative organs, guided partly by the anterior aorta, gains the fissure where the confluence of the ducts from the different parts of the generative apparatus exists, and

is then subdivided among the testis, the oviduct, the mucus-gland, &c. It seems more than probable that the penis receives a twig from this nerve, and that the spermatheca and ovarium are also supplied from it, though we have not traced branches so far. If any branches pass from this nerve to the heart, which we are inclined to believe is the case, they probably run along the anterior aorta.

We think it only right to remark, that not having traced this nerve with the same precision as the rest, we do not feel ourselves competent to speak so decidedly of its distribution as we could wish.

The nerve γ arises from the third or hindermost collar at the side, passes backwards to the aperture previously noticed as existing in the buccal mass, and therein is applied to the surface of the nerve that issues from the opening, and further we have been unable to follow it.

In addition to these we have the nerve marked δ , which appears to be single; it comes off from the inner margin of the posterior segment of the middle slender collar near the median line, and has been traced to the under surface of the anterior portion of the stomach. There appears to be a small fusiform swelling on this nerve.

The last nerve to be mentioned, and which is designated ϵ , is somewhat inferior in size to the fifth infra-oesophageal, and as before stated emerges from the aperture among the muscular bundles of the posterior part of the buccal mass. On attempting to follow this nerve more deeply, we find it to end in what seems to be a ganglionic swelling ζ , from which nervous branches apparently radiate throughout the muscular tissue of the buccal mass. If this nerve be traced in the opposite direction from the intermuscular aperture, it is found to pass forwards, inclining at first inwards, and as it approaches the outermost collar receives obliquely from it, near the union of the collar with the buccal ganglion, a branch of communication, η ; it next runs under that collar, and then under the middle one; after this still passing forwards and approaching the posterior margin of the lateral supra-oesophageal ganglia, it turns outwards, hooking round over the two outer collars, but having no connexion with either at this part, and reaching the skin at the side of the buccal mass, it bifurcates, one branch passing forwards, the other backwards; they both send off numerous twigs which have been followed to the ramifications of the gastric system at the bases of the papillæ.

In *E. olivacea*, *E. coronata*, Pl. VI. fig. 1, and *E. Drummondi*, Pl. V. fig. 2, the central masses and the nerves emanating from

them, and the commissures, excepting the modifications to be presently mentioned, are pretty much the same, as far as we have been able to examine them, as they exist in *E. papillosa*.

In *E. coronata* the olfactory tractus are much shorter, and their ganglia more globular, and of much greater relative size than in *E. papillosa*, being indeed more than one-third the size of the lateral supra-œsophageal ganglia themselves. There is besides one principal nervous stem from the ganglion which runs up the central axis of the tentacle.

In *E. Drummondi* the relative size of these ganglia is still greater and their form elliptical. The existence of these ganglia we believe to be constant in all the species; we observed them in *E. pellucida*, *E. Farrani*, *E. alba*, *E. gracilis*, *E. picta*, *E. punctata*, &c.

The three nervous collars of the œsophagus can be observed easily in *E. Drummondi*, in which there appears to exist at the coming off of the genital nerve from the middle or slender collar a small ganglionic swelling θ . A similar swelling occurs also in *E. coronata*.

When viewed attentively with the naked eye, the cerebral ganglia, and particularly the first or median pair, present a number of large globular vesicles inclosed within a transparent membranous envelope. When compressed and somewhat magnified, all the ganglia seem to be made up of masses of vesicles, as the view of a buccal ganglion, Pl. VI. fig. 2, will show. Under a higher power these vesicles or cells are found of very variable size, externally smooth, internally granular, and having one or more large distinct nuclei and nucleoli; some have only one large nucleus and a distinct nucleolus; the interior is filled with smaller cells of different dimensions and also nucleated; the smallest of all however are minute, clear, bright cells, probably nuclei or rather nucleoli of larger vesicles. Many of these last are found also lying in the intervals of the large cells intermixed with the tenacious semifluid matrix that imbeds the nervous vesicles, and in which no distinct forms can be discerned. On tearing up one of the cerebral ganglia and examining the contents of the membranous envelope in the compressor, under a high power (one-eighth object-glass), numbers of the cells of all sizes are seen under the form of pear-shaped, largely nucleated vesicles, Pl. VI. fig. 4, having a long pedicle attached; the nucleus, which is very large, has an evident and well-marked nucleolus, and the pedicle or stalk of the cell is in the interior very finely granular. Groups of these pedicled ovoid vesicles may be observed, such as that at Pl. VI. fig. 3, their pedicles all lying in the same direction, and tending either to unite or to run on parallel to each other, putting us strongly in mind of some of the simpler forms of glan-

dular apparatus. We cannot confidently say that we have traced groups of these pedicles into the nerves that issue from the ganglia, but we have seen what inclines us very strongly to the idea, that such is in reality the relation of these two parts of the nervous system. At Pl. VI. fig. 2, where a nerve *b* is shown coming off from a buccal ganglion *a*, parallel striæ are observed distinctly passing towards the nerve from the interior of the ganglion. Again, when the connexions of the nerves with the cerebral ganglia are examined, parallel striæ can be seen continued from the commencement of the nerve for some distance into the ganglion, becoming gradually more and more obscured by the vesicles of the ganglia and then lost altogether; but from the toughness of the enveloping membrane—the body of the Nudibranch having lain for some time in spirit and water—and the extraordinary delicacy of the contained parts, we have not been able to lay bare, and leave *in situ*, in one and the same specimen, the real connexion which we believe to exist between the nerves and the vesicular element of the central ganglia. But we hope that further observation will enable us to show that the pedicles of the nerve-corpuscles in *Eolis* are continuous with the nerves; and if this be so, then that it may be the means of illustrating more clearly the connexion that exists in the Vertebrata and in Man between the nerves and the white and the gray matter of the brain and the rest of the centres of the nervous system. It is highly probable, however, that all the cells of the ganglia possess a pedicle or stalk in their perfect state, and that the apparent absence of a pedicle or pedicles in some cells or groups of cells may be owing either to the unfavourable aspect under which they are presented to the eye—they being so placed that the pedicle is either very much foreshortened or hidden altogether by the cell itself, or else to the pedicle having been broken off during the manipulation of the specimen, or again to the magnifying power in some cases not being sufficient to make them discernible, or lastly to their imperfect state of development.

These cells or vesicles of the nervous ganglia of *Eolis*, although they show only one cauda or prolonged pedicle, are doubtless analogous to those caudate vesicles or nerve-corpuscles which are characteristic of the gray matter of the cerebro-spinal and sympathetic ganglia of the higher animals.

The nerves themselves appear to have none of the cells above noticed, but to consist of series of parallel granular lines or fibrillæ, which on tearing the nerve across often remain detached from each other, and which are all in their perfect state enveloped in a strong common sheath continuous with the membranous capsules of the ganglia. Where a nerve gives off branches, lines of granular matter, probably the fibrillæ just mentioned, are

separated from the main stem and become inclosed in a sheath of their own, and this mode of division appears to be carried on to a very minute degree. We have not been able to detect the manner in which the nerves actually terminate; certainly we have seen nothing to warrant the description and the figures of M. de Quatrefages relative to this particular.

On taking a review of the nervous system of *Eolis*, we are at once struck with the high grade of development, and with the symmetrical arrangement that obtains in it; the heterogangliate character applicable to many gasteropodous mollusks being, so far as our researches have led us, inapplicable to this more elevated being. The nervous centres are closely concentrated around the œsophagus, and there exists a sufficient correspondence between them and the same organs in the Cephalopoda to enable us confidently to compare them; indeed we have every reason to think that we recognise in them the homologues of the principal masses of the nervous centres of the Vertebrata.

If we turn to Professor Owen's memoir on the Pearly Nautilus, pl. 7. fig. 1, in which the nervous system is represented, we find that the supra-œsophageal mass or brain together with the attached optic lobes, taken in conjunction with the anterior œsophageal ring formed by the union of two ganglia, corresponds to the anterior supra-œsophageal ganglia of *Eolis* with the slender or middle collar round the œsophagus, since they give off nerves which go to supply analogous parts, viz. the eyes, tentacles, lips, &c. The posterior œsophageal ring of the Nautilus to a great extent represents in the same way the lateral supra-œsophageal ganglia of *Eolis*, united with all the infra-œsophageal ganglia and the two large collars or commissures together.

At fig. 3, same plate, Professor Owen gives a view of the nervous system of the *Sepia officinalis*; the homology is equally distinct as in the former case, only the parts are more concentrated; still they serve to lead us on more easily to compare the ganglia of *Eolis* with the several divisions of the more highly-developed nervous centres of the Vertebrata. In *Eolis* we see that certain nerves of relation—of special and common sensation, and their corresponding nerves of motion, voluntary or reflex—are in connexion only with the two pairs of supra-œsophageal ganglia. The olfactory and optic nerves, and numerous others to the lips, mouth, tentacles and side of head and back, are thus attached; hence we infer that the anterior part of the supra-œsophageal ganglia may be in some measure compared, though not perhaps quite accurately, to the cerebrum and optic lobes of the Vertebrata; at all events these are the only parts to which they correspond. The posterior parts of the median cerebral ganglia, and

the remaining ganglia together with their commissures and collars, are the representatives of the medulla oblongata and spinal cord of the higher animals.

We do not discern in *Eolis* anything at all analogous to the sympathetic system of the higher animals.

In the nervous system again we are sorry to be compelled to be at issue with M. de Quatrefages, who states in his paper that "toutes les grandes masses nerveuses sont réunies au-dessus de l'œsophage et d'elles seules émanent directement les nerfs qui se rendent dans toutes les parties du corps." Subsequently however he points out the presence of a single small ganglion below the œsophagus, from which small nervous twigs are given off to the mouth and digestive tube. The incorrectness of these and other observations we hope to have rectified. Further, M. de Quatrefages makes out only one nervous œsophageal ring; we have over and over again seen and verified the three represented in our plate. The nerves of vegetative life he derives from the same ganglia that give off the nerves of relation, and points this out as an interesting fact. The rule with two or three exceptions appears to be, that the two sets of nerves have two appropriately distinct sets of ganglionic centres, viz. the infra-œsophageal for vegetative life, and the supra-œsophageal for the life of relation, which is agreeable to analogy. With regard to the number and arrangement of the nerves, we find M. de Quatrefages to be again in confusion. His number is very far short of the full complement, and he has traced scarcely any to their proper destination. We observe that he gives to the optic nerves a ganglionic swelling which we have never seen, and omits the olfactory ganglion, which may be seen even during life in the more transparent species.

We do not understand M. de Nordmann's account of the nervous system. It is possible that in that section of the genus *Eolis* to which *Tergipes* belongs, the nervous system may differ from that of the other divisions, but we should be surprised to find it so different from that of those we have dissected, as it is represented in M. de Nordmann's paper.

The Senses.

The organs of the senses appear to be as highly developed in *Eolis* as in any other of the Gasteropods. The sense of touch is spread over the whole surface of the body, including the foot, the tentacles, and the branchial papillæ, which last are so extremely sensitive as to respond to the slightest undulations of the water around them. Many of the species indeed are so alive to such impressions, that it becomes a matter of difficulty to observe their habits, and even their natural form, since on the slightest

motion of the water they curl up their foot and fall to the bottom.

The oral tentacles, which are kept in perpetual action, seem to possess the sense of touch in an exquisite degree; so much so that we are led to conclude, that from this circumstance, and from their anterior position, they ought to be regarded as special organs of touch.

Taste, if present, most probably resides in the lining membrane of the buccal cavity, particularly in the folds at the back of the tongue (1st paper, Pl. I. fig. 8 *h*) and the cheek-mass, *ef*, and perhaps also in the laminae at the commencement of the oesophagus.

When describing the third pair of nerves, we stated that we considered the dorsal tentacles to which these nerves pass to be distributed, as the olfactory organs, and for this opinion we now proceed to adduce reasons which appear to be sufficient.

That these tentacles are special and very important organs, a consideration of the internal anatomical arrangement of their nervous element and of the peculiarities of their external form, peculiarities susceptible of great variety, would seem to leave very little doubt in the unprejudiced mind.

First of all a large nerve, Pl. V. fig. 3, among the largest in the body, comes off from the front of the median cerebral ganglion; and secondly, this nerve, or more properly speaking, tractus, has superadded to it at the base of the tentacle a well-defined ganglionic swelling, *e*, of a size exactly proportioned to the extent of complexity in the external form of the tentacle. Thus in *E. papillosa*, in which the tentacle is smooth and in its simplest form, the ganglion is considerably less than in *E. coronata*, Pl. VI. fig. 6, and *E. Drummondi*, in both of which the tentacle has a surface of a far more complicated kind, being rendered much more extensive by the addition of numerous broad, circular laminae; the ganglion being in these two species, as before noticed, upwards of one-third the size of the lateral supra-oesophageal ganglion itself, Pl. VI. fig. 1 *e*, and Pl. V. fig. 2 *e*.

If further evidence be required to illustrate the importance and special nature of these organs, we may go from the genus *Eolis* to the other members of the family *Eolididae*, as for instance to *Eumenis marmorata*, in which we find the laminae so closely set as to conceal the whole shaft of the tentacle, and moreover there exists a sheath at the base of the tentacle into which it can be retracted at the will of the animal. A sheath also exists in *Doto*, Pl. VI. fig. 7, into which the organ, though simple in form, is completely retractile. The same is found likewise in *Dendronotus arborescens*, Pl. VI. figs. 8 & 9, in which the tentacle is remarkable for highly developed laminae; and here the

sheath, which is long, and into which the tentacle is quite retractile, is garnished around its extremity by a circle of arborescent filaments, by which the organ even, when extended, is to a great degree protected from injurious contact with surrounding objects.

Again, as if the laminated disposition of the tentacle were not sufficient for the purpose of the *Antiopa splendida*, Pl. VI. fig. 10, we have these organs, *a a*, standing out from the sides of a median crest, *b*, which is elevated above the surrounding skin, and crowned by a series of pinnate laminae. That this median crest is really a part of the olfactory organ, an addition to its complexity, is proved by the attendant modification of the nervous element, which is as follows. There is directly in front of and in contact with the median cerebral a pair of small ganglia, *c c*, each of which gives off two branches, one of which, *d*, goes to the tentacle, and the other, *e*, much thicker, goes to one half of the median crest.

We could easily adduce other examples from the *Dorididae*, if others were required, to show the importance and the speciality of these organs in the Nudibranchiata, but those we have brought forward seem enough for this purpose. Another circumstance bearing upon the special nature of these tentacles, and noticed by Joshua Alder, Esq., one of the authors of this paper, in a communication made to the British Association at the Cork meeting, is that the cilia on their surface vibrate in a direction contrary to that of those on the surface of the branchial papillae. On these the cilia move constantly from the body towards the extremity of the papilla; on those they act from the point of the tentacle towards the body; thus, in the former case, the water which has served for respiration is drawn from the body and thrown off from the apices of the papillae, whilst in the latter the fluid which we may suppose to contain odorous particles or qualities is attracted to the end of the tentacle, and made to pass down over the entire surface, and then thus to act upon the sentient nerve within.

Now it is a constant occurrence in the higher animals that the fluid to be tested by the olfactory organ is always brought to the nerve, and made to pass over the sensitive surface in the majority of instances by means of the agency of inspiration. In fishes however in which the nasal cavity is shut off from the mouth and throat, another agency than that of respiration is required; the olfactory plates however are freely supplied with cilia, and these probably act a part analogous to those of the laminated tentacles of *Eolis*. But the dorsal tentacles are not only, according to our view, important and special organs, but they are, further, organs of smell. Their laminated structure is one evidence of this. The

organs pointed out by Professor Owen in his memoir on the Pearly Nautilus, which "consist of series of soft membranous laminae compactly arranged in a longitudinal direction, and situated at the entry of the mouth, between the internal labial processes," are similarly constructed, and also supplied with nervous filaments from a pair of ganglia that are connected with the anterior cerebral or brain.

In fishes the olfactory organ consists of delicate membranous laminae, arranged in a manner not widely different from the disposition of those of *Eolis*; they are disposed, as in the *Dorididae*, in a pinnate manner, attached to a central stem: examples of this may be seen in the dace and in the burn trout, Pl. VI. fig. 12.

In the higher Vertebrata the laminated form is evident wherever we look. It may be objected to this argument, that in the case of *Eolis* the laminae are arranged on the exterior of the tentacle, and in the Vertebrata in the interior of a cavity; but if we can conceive of the tentacle of a *Dendronotus*, or of a *Doris coccinea*, Pl. VI. fig. 11, retracted within a sheath, we have then a very good representation of the olfactory organ of the fish.

Further, the ganglia of the tentacular nerves are in front of all the rest, and are attached by their tractus to the anterior part of the cerebral mass,—the anterior median ganglia, an arrangement which, together with the anterior superior position of the tentacles themselves, perfectly corresponds to that of the acknowledged olfactory apparatus in fishes and all other Vertebrata.

Lastly, if these tentacles be olfactory organs, we should expect, in tracing downwards the animal scale, that they would disappear before the tactile organs, the oral tentacles. That such is the rule even in the Mollusca we have the authority of Professor Owen. From what we have brought forward on this subject respecting the anatomical details, the external configuration, and the homology of the dorsal tentacles of *Eolis*, we feel justified in assigning to them the office of olfaction rather than in supposing them to be the seat of some new and hitherto undescribed and mysterious sense, or even of touch, as is generally believed. That they are not for touch seems to be indicated in some measure by their dorsal position, their direction upwards, and by their being in some instances defended from external mechanical injury by a fence of delicate processes, as in *Dendronotus arborescens*, Pl. VI. fig. 8.

The sense of vision is subserved by two minute organs somewhat inferior in development to those of the higher Gasteropods. They are situated beneath the skin, and are visible to the naked eye as two black dots immediately behind the dorsal tentacles; they are each supported by what appears to be a short thickish

pedicle, the optic nerve, Pl. V. figs. 1 & 2, no. 16, which comes off from the upper surface near the middle of the external border of the median cerebral ganglion, close to its connection with the lateral one. The nerve is directed forwards, outwards and upwards, and varies somewhat in length in different species; it is covered by a very delicate transparent sheath: the eye itself, Pl. V. fig. 3, has a wide external envelope—a delicate transparent capsule, *a*, continuous with the sheath of the nerve. This envelope holds the place of the cornea and sclerotica of more highly organized eyes. Within it is contained an irregularly-shaped cup, *b*, of black pigmentary matter, which embraces the posterior half of a spherical, colourless, highly refractive crystalline lens, *c*.

The anterior border of this pigmentary or choroid coat appears to be free, and is irregularly crenate. Over the front of the lens, and separated from it by a narrow interval, is a transparent tunic, *d*, which is most aptly compared to the anterior capsule of the lens of the higher animals, though some may deem it the homologue of the cornea. The back part of the choroid coat seems to be pierced by the optic nerve, but from the minuteness of the organ and the opacity of the choroid, we have not been able to determine the exact relation of the retina to the pigmentary layer, nor the existence of a vitreous body.

The degree of vision enjoyed by these animals must be slight. They can distinguish light from darkness, and can probably appreciate imperfectly different degrees of light, and as the eyes are placed under the skin of the head, their perception of objects must be exceedingly faint and indistinct.

The auditory apparatus consists of a minute, elliptical, delicate, and transparent capsule, Pl. V. figs. 1 & 2. no. 17, less than the eye, directly behind which it is situated; it appears sessile upon the external border of the median cerebral ganglion, but there are faint indications of a pedicle or a nerve that enters the capsule at the front. The long diameter of the capsule lies in the antero-posterior direction; within this capsule, figs. 4 & 5 *a*, is another, *b*, still more delicate and much smaller. This latter contains numerous very minute, oval corpuscles or otolithes, fig. 4 *c*, smooth, transparent, and highly refractive of light. In the centre of each an obscure dot, fig. 6, occurs, which, when highly magnified, exhibits a distinct appearance of nucleus and nucleolus. They are seen as we have described them in *E. papillosa* and *E. coronata*; but in *E. aurantiaca* and *E. olivacea*, in *E. picta* and *E. exigua*, there is only one large spherical otolithe, fig. 5 *b*, which presents also indications on its surface of nucleus and nucleolus.

These capsules are specimens of the auditory organ in perhaps its simplest form, and as such are adapted for the most limited

perception of sonorous undulations. Since it has been ascertained that *E. punctata* and *Dendronotus arborescens* do emit sounds, it seems probable that these organs may be provided for the perception of such. These crystalline-looking bodies are stated to be calcareous, but on treating them with acetic acid we did not find after the lapse of some time that any material change had taken place.

In investigating the different organs of *Eolis*, we have endeavoured, as we at first proposed, to place their anatomy and physiology in as clear and correct a light as possible, and to show in what particulars we differ from M. de Quatrefages, and now in terminating this memoir we are in a position to state, that his anatomical details are with regard to every organ more or less erroneous.

We are very glad therefore to learn that he has been led to forgo his proposed order *Phlebenterata*, and we may express a hope that the whole hypothesis of Phlebenterism as applied to the Mollusca will soon be abandoned. This Phlebenterism, which was first brought to light by M. Milne-Edwards, and maintained by him and M. de Quatrefages and some of the most distinguished French naturalists, and which implies a fusion of the digestive and vascular systems by a marked degradation of the latter that reduces these Nudibranchiata almost to the condition of the Radiata, is, if we understand it at all, founded on the assumption that no veins or true auricle any more than a true intestine exists in the *Eolididæ* and other allied genera,—that the functions of respiration, chylication, and the secretion of bile are cumulated in the branchial papillæ, and that the ramifications of the digestive system in some way or other supply the deficiency which was supposed to exist at the venous part of the circulation, and also distributed the digested portions of aliment throughout the body. But on full consideration of what is put forth as Phlebenterism in the Mollusca by the French naturalists, we confess our inability to arrive at a precise understanding of what is meant by the term. We believe we have in our account of the anatomy of *Eolis* brought forward evidence enough to overthrow Phlebenterism, such as we conceive it to be as applied to these animals, and we will now in conclusion, and as briefly as we can, recapitulate what we have before advanced, adding some new observations which now occur to us.

First, we have demonstrated that the vascular system is not in that state of degradation supposed by the French savans. We have shown a well-formed heart, consisting of ventricle and auricle, inclosed in a pericardial sac, the ventricle giving off an aorta that branches away to supply the principal viscera and the foot. The

hepatic artery is wanting, but the fact of the liver being minutely divided among the branchial papillæ, and the divisions being thus placed in contact with aërated blood, explains this hiatus and necessitates it. The auricle receives three principal venous trunks, each of which is made up of several branches from the skin anteriorly and posteriorly. These trunks have been called branchio-cardiac by M. Milne-Edwards and his followers, under the conviction that the whole of the blood passes to the heart from the branchial papillæ by them. We find nothing in *Eolis* to favour the opinion that the whole of the blood is conducted by afferent vessels from the body or intervisceral lacunæ direct to the branchiæ, and thence exclusively by efferent vessels to the auricle. We see that the network of lacunæ in the thickness of the skin receives the blood from the interior of the body, and allows it to flow freely therein in all directions; part of it doubtless passes to the branchial papillæ, but part also must go at once along the veins to the auricular part of the heart. In other words, the veins draw their blood from the sinuses or lacunæ of the skin, and this suction, so to speak, attracts the vital fluid at one and the same time from the branchial papillæ and the lacunæ of the body, so that the veins, instead of being merely branchio-cardiac, are really both systemic and pulmonary together. We have likewise pointed out small veins going from one of the viscera, the ovarium, into the skin at the side of the body, and even a small vessel of similar character going from the ovarium into the posterior median trunk-vein; the latter of course are systemic veins. Again, we find corroboration of this view of the parts in *Eolis* if we look to *Doris*: here the auricle receives three branches, one from each side, and one from behind as in *Eolis*; this last branch in *Doris* is made up of veinlets from the respiratory organs alone, and hence may properly be called pulmonary or branchio-cardiac; the two lateral branches come not from the special respiratory organ at all, but directly from the skin. Now although the skin in *Doris* may have in some measure a function like that of the *Eolididæ*, it must from its peculiar nature perform that function in a most imperfect manner; hence we ought to look upon these lateral venous trunks in a corresponding inverse ratio as systemic veins. Thus both in *Doris* and in *Eolis* the blood enters the auricle in a state of only partial aëration, one portion reaching it from the respiratory organ, and another from the general system. In the Crustacea the blood in the great dorsal sinus is in the same state, a fact that John Hunter had long ago ascertained, and Professor Owen has more recently confirmed. Here surely there is not that degradation implied in the idea of Phleboterism; and according to M. Milne-Edwards' own showing, the

vascular system is at least as perfect in the *Eolididæ* as in the *Dorididæ*,—nay even as complete as in the majority of the Gasteropoda.

Secondly, the nervous system has been shown to consist of ganglia well-developed and concentrated, and of numerous and large nerves; the eye, the ear, taste perhaps, certainly common sensibility exist, smell as well, and if our views be correct, to as high a degree as in any of the Mollusca; in short, the nervous system has reached a grade of organization higher than in the majority of the Gasteropods. This is most important evidence that the *Eolididæ* are not in the degraded state implied by Phlebenterism.

Thirdly, in these animals the respiratory system may be looked upon as somewhat less specialized than in other Gasteropoda, but it is sufficiently developed and specialized in the branchial papillæ to prevent us from attributing its function, even in part, to the prolongations of the digestive system.

Fourthly, we have pointed out the singular development and complexity of the genital organs, which are not in these respects inferior to many other Gasteropoda, and certainly similar to the genitalia of the *Dorididæ*, with the exception that in *Eolis* the ovarium is much more bulky.

Fifthly, from the certainly not lower state of development of those systems of organs we have enumerated, it ought not to be expected that there should be any degradation of the digestive system of *Eolis*, and accordingly we find fleshy sensitive lips with superadded tentacles, a strong muscular buccal mass with horny cutting jaws, and a spiny prehensile tongue, minute salivary apparatus, a constricted œsophagus, a well-marked stomachal sac, with the adjunct of a distinct intestine ending in a lateral anal nipple. So far we find no deviation from the Gasteropodous type; the liver however is as it were broken up into as many pieces as there are branchial papillæ, and which by a series of ducts of variable number communicate with the stomach. Why, it may be asked, does the hepatic organ not occupy its usual place in the body? The enormous development of the ovary we suppose necessitates the removal to the exterior which we observe, and the organ thus thrust out is divided among the papillæ, apparently for the purpose of ensuring its being constantly bathed with aërated blood, whilst at the same time by this arrangement the body of *Eolis* is kept of small dimensions, a condition probably rendered necessary by some peculiarities in the œconomy and habits of the creature with which we are unacquainted. By this arrangement also the hepatic artery becomes unnecessary.

Phlebenterism supposes that the chyle or nutritive part of the food passes into the blood-current of the system through the

ramifications as they are termed of the gastric cavity, which are prolonged into the papillæ. It cannot however be contended that the chyle is transuded through the granular or glandular part, such as occurs in many of the *Eolididæ* in the papillæ, since it is manifestly a secreting and not an absorbing surface, and the current must set from without inwards. Now in *E. despecta* the central duct or stem, and its accessory ducts, as well as their terminations in the papillæ, are granular throughout; therefore the fact of the whole apparatus being one for secretion precludes the idea that the products of digestion can pass into the system from this organ. This arrangement we see in a still more striking manner in several others of the *Eolididæ*, as in *Hermæa dendritica*, in which all parts of the much-branched hepatic organ are alike granular. In *Eumenis marmorata*, in which they are even follicular throughout, and in *Dendronotus arborescens**, the central duct is crowded with compound follicles, and all the branches are more or less follicular for a short distance, and then become simply granular; indeed in this genus the posterior part of the stomach and the intestine are the only parts which are free from the above granular character. We are therefore led to conclude that it is from the pyloric end of the stomach and from the intestine that exudation or absorption of the chyle takes place, and this conclusion is strengthened by the fact, that it is in the intestine that the contents first assume their fæcal character. We may add also that in *Doto*, the intestine, which is short and wide, is in the interior longitudinally plicated, as if thus to increase the extent of the absorbing surface.

In conclusion then we hope to have shown, that not in any of the systems of organs is *Eolis* notably below the Nudi-branchiate type; and we trust that this memoir, if it serve no other purpose, will at least assist in rescuing this genus, and

* In this genus we see an intermediate link between those members of the Nudibranchiata which are provided with a concentrated internal hepatic organ and the *Eolididæ*, a fact which we pointed out two years ago. The central duct is in fact nothing else than a true liver reduced somewhat in bulk, but being diffused by its prolongations into the branchial papillæ. Another intermediate form and still more interesting link between the two extremes, as it exhibits the first step in the deviation of the liver from the typical state, is seen in *Scyllæa*, and which we noticed in a paper communicated to the Oxford meeting of the British Association. The liver in *Scyllæa* is broken up into several globular masses of convoluted tubes sending off minute branches that ramify in the skin and penetrate the branchial tufts. In a paper by M. E. Blanchard in the 'Annales des Sciences Naturelles' for March 1848, we observe that that gentleman has discovered in *Tethys* a similar arrangement of parts, and points this out as an excellent intermediate illustration of the affinities that exist among the different members of the Nudibranchiate group, and we are happy thus to find in his researches a corroboration of the fact which we had previously cited for the same end.

through it the *Eolididæ*, from the degradation which M. de Quatrefages and others from imperfect observations had too hastily imputed to them.

EXPLANATION OF PLATES V. AND VI.

PLATE V.

Fig. 1. Nervous system of *Eolis papillosa*: *a a*, median supra-œsophageal or cerebral ganglia; *b b*, lateral supra-œsophageal ditto; *c c*, buccal ditto; *d d*, gastro-œsophageal ditto; *e e*, olfactory ditto; *f*, anterior median commissure; *g*, posterior median ditto, or commissure of the buccal ganglia; *h h*, commissure between median and lateral supra-œsophageal ganglia; *i*, innermost or shortest œsophageal nervous collar; *j*, slender or middle ditto; *k*, outermost or widest ditto.

Nerves from supra-œsophageal ganglia: Nos. 1 and 2, small nerves to skin of head; 3, olfactory tractus or nerves; 4, nerve to the outer lip; 5, ditto to skin of head between dorsal tentacles; 6, ditto to oral tentacles and roof of channel of mouth; 7 and 8, ditto to skin of side of head; 9, ditto to muscles attaching buccal mass to skin, and to sides of channel of mouth; 10 and 11, ditto to skin at side of head; 12 and 13, ditto to skin down side of body below the rows of papillæ; 14 and 15, ditto to skin of side of head near the tentacles; 16, optic nerves; 17, auditory ditto; 18, nerves to the foot; 19, ditto to skin down side of body to papillæ (respiratory nerve); 20, ditto to skin of back; 21, 22 and 23, ditto to skin of back near median line.

Nerves from infra-œsophageal ganglia: 1, small nerves to stomach; 2, 3 and 4, smaller ditto to œsophagus and stomach; 5, large ditto passing into the buccal mass; 6, small ditto to back part of buccal mass.

Nerves from œsophageal collars: α , minute nerves from innermost collar, destination unknown; β , genital and probably cardiac nerves; γ , nerves from outermost collar passing into buccal mass; δ , single nerve from middle collar, probably gastric; ϵ , large nerve coming out of buccal mass from a ganglionic swelling, and passing to be distributed to glands of papillæ of skin; ζ , the ganglionic swelling situated in buccal mass, from which the large nerve ϵ comes off; η , branch of communication between the large nerve ϵ and the outermost œsophageal collar.

Fig. 2. Nervous system of *E. Drummondi*. The letters correspond to those in last fig. except one, θ , which marks a small ganglionic swelling in connexion with middle collar and genital nerve.

Fig. 3. Eye of *E. picta*: *a*, outer capsule; *b*, pigmentary cup; *c*, lens; *d*, capsule of ditto.

Fig. 4. Auditory capsule of *E. papillosa*: *a*, outer capsule; *b*, inner ditto; *c*, otolithes.

Fig. 5. Auditory capsule of *E. picta*: references as in last fig.

Fig. 6. Two otolithes from *E. papillosa* highly magnified ($\frac{1}{8}$ th object-glass), showing nucleus and nucleolus.

PLATE VI.

Fig. 1. Nervous system of *E. coronata*. Letters as in Plate V. figs. 1 & 2.

Fig. 2. *a*, buccal ganglion of *E. papillosa* slightly compressed and magnified to show the vesicular contents; *b*, nerve coming from same.

- Fig. 3. Group of pear-shaped nerve-globules with pedicles all lying in same direction, the globules showing large nuclei and nucleoli from cerebral ganglion of *E. papillosa*.
 Fig. 4. Two isolated, pear-shaped, pedicled, nucleated nerve-corpuscles of large size from the same.
 Fig. 5. Smallest cells, bright and transparent, probably nucleoli, from the same.
 Fig. 6. Side view of dorsal tentacle of *E. coronata*: *a*, olfactory ganglion and nerve.
 Fig. 7. Dorsal tentacle with sheath, *Doto fragilis*.
 Fig. 8. Lateral view of ditto ditto, *Dendronotus arborescens*.
 Fig. 9. Front view of ditto ditto ditto.
 Fig. 10. Side view of dorsal tentacles and laminated crest of *Antiopa splendida*: *a a*, tentacles; *b*, laminated crest; *c*, ganglionic swelling in front of median cerebral ganglion; *d d*, tractus olfactorius to laminated crest; *e e*, ditto ditto to tentacle.
 Fig. 11. Front view of dorsal tentacle of *Doris coccinea*, showing central stem and laminæ.
 Fig. 12. Olfactory laminæ of Burn Trout, showing its resemblance to those of *Doris coccinea*: *a*, nostril; *b*, central stem; *c*, laminæ.

XX.—Brief Notice of several Mammalia and Birds discovered by B. H. Hodgson, Esq., in Upper India. By THOMAS HORSFIELD, M.D. &c.

DEAR SIR,

Library, East India House, Feb. 12, 1849.

B. H. HODGSON, Esq., late British resident at Nepal, who is now zealously pursuing his researches into the natural history of the upper provinces of India, has lately presented to the museum of the East India Company, a small collection of mammalia from the neighbourhood of Sikim and Darjeling, and two birds from Tibet; and (Mr. Hodgson) being desirous that a concise notice of them may be communicated to the public without delay, until he shall have an opportunity of publishing a more detailed description of the new species, I request you, in his name, to insert the following list, with a few remarks, into an early number of the 'Annals and Magazine of Natural History.'

Yours faithfully,

Richard Taylor, Esq.

THOMAS HORSFIELD.

List of MAMMALIA from Sikim and Darjeling, near Nepal, in Upper India.

Numbers 1 to 4 have already been described and published.

1. Genus PORCULA, Hodgson, Journal of the Asiatic Society of Bengal, vol. xvii. p. 423, with a figure.

Type *Porcula Salvania**, Hodgson.

* *Salvania*, of or belonging to the Saul forest.

Sp. Char. Pigmy hog of a black-brown colour, slightly and irregularly shaded with sordid amber; iris hazel; nude skin dirty flesh-colour; hoofs glossy brown. Length from snout to vent 18 to 20 inches; height 8 to 10 inches; weight 7 to 10, rarely 12 lbs.

2. *Talpa micrura*, Hodgs., Classified Catalogue of Mammals of Nepal; Journ. As. Soc. Beng. vol. x. p. 910.

3. *Rhizomys badius*, Hodgs., Classified Catalogue of Mammals of Nepal; Journ. As. Soc. Beng. vol. x. p. 915.

4. *Lepus (Caprolagus) hispidus*, Pearson. Described by J. T. Pearson, Esq. in the 'Bengal Sporting Magazine.'

The following Mr. Hodgson indicates as undescribed, and they form an appropriate supplement to his Essay on the Rats, Mice, and Shrews of the Central Region of Nepal, printed in vol. xvi. of the 'Annals of Natural History,' &c. p. 266, &c.

5. *NEODON*, n. g., Hodgson.

Neodon Sikimensis, Hodgs. This animal Mr. Hodgson considers as a new type, though in many respects allied to *Arvicola*. Mr. J. E. Gray at my request has kindly compared the specimen with the Murines from India contained in the British Museum; it appears to be nearly allied to *Arvicola Roylei*, Gray, described in the 'Annals of Natural History,' vol. x. p. 265. There are, however, in the *Neodon* some differences in the folds of the upper and lower grinders; these, with the other distinguishing characters of this type, will be pointed out in Mr. Hodgson's detailed description.

6. *Mus æquicaudalis*, Hodgs. Tail equal in length with the body.

7. *Mus caudator*, Hodgs. Tail exceeding the body in length.

8. *Mus Darjilingensis*, Hodgs.

9. *Sorex Sikimensis*, Hodgs.

10. *Sorex caudatus*, Hodgs.

BIRDS.

1. *Pica Tibetana*, Hodgs.

Mr. G. R. Gray, who has carefully compared this bird with specimens in the British Museum, states that "it differs from the European by its greater size, and by the white of the quills not extending to near the tip. In the English specimens the white comes within 8 lines of the tip." It appears to be allied to *Pica megaloptera*, Blyth, Journ. As. Soc. of Bengal, vol. xi. p. 193.

2. *Corvus Tibetanus*, Hodgs. Nearly allied to *Corvus corax*, but somewhat larger in size: the bill also is stouter.

XXI.—Notes on Chalcidites, and Descriptions of various new species. By FRANCIS WALKER, F.L.S.

Isosoma Maderæ, fem. *Æneo-atrum*, capite fulvo bimaculato, antennis pedibusque nigris, genubus tarsisque fulvis, alis subflavis.

Body black, convex, with a scarcely perceptible bronze tint, sparingly clothed with hairs: head and chest punctured: head transverse, subquadrate, somewhat rounded in front, shining, very finely punctured, having two very indistinct tawny spots behind, a little broader than the chest: eyes dark red: feelers black, somewhat slender, rather more than half the length of the body; their breadth increases but very slightly from the base to the tips; first joint long, bright tawny, slightly spindle-shaped; second long-obconical, piceous, tawny at the tip; third a little longer than the second; fourth shorter than the third; fifth shorter than the fourth; the two following joints also successively decreasing in length; club spindle-shaped, very little broader but more than twice the length of the seventh joint: chest nearly spindle-shaped, broader in front: fore-chest subquadrate, shining, very finely punctured, a little broader than long, well developed; fore-angles tawny and somewhat rounded: shield of the mid-chest shining, very finely and sparingly punctured, almost narrower than the fore-chest; sutures of the parapsides very strongly marked, converging till they reach the hind-border of the shield, where their distance from each other is a little less than one-third of its breadth; axillæ large, and nearly conniving on the back, being separated there from each other by less than one-sixth of the breadth of the chest; scutcheon conical, rather more thickly punctured than the fore-part of the body; it has a rim along its hind-border which joins the hind-scutcheon; the latter is very short: hind-chest well developed, declining, obconical, rugulose: petiole short, rugulose, nearly cylindrical, not half the length of the hind-chest: abdomen long-elliptical, smooth, shining, clothed with a few white hairs, compressed at the tip, a little shorter but hardly broader than the chest; metapodeon occupying about one-fourth of the back; octoon not half the length of the metapodeon; ennaton a little shorter than the octoon; decaton a little longer than the ennaton; each of the three following segments equalling the decaton in length: legs black; knees, feet, and tips of thighs, of hips and of shanks tawny; tips of four hinder feet piceous: wings with a slight yellow tinge; veins luteous; ulna much less than half the length of the humerus; radius shorter than the ulna; cubitus shorter than the radius; brand very small. Length of the body $1\frac{1}{2}$ line; of the wings $2\frac{1}{4}$ lines.

This and the twelve following species were found in the island of Madeira by Mr. Wollaston, to whose kindness I am indebted for the opportunity of examining them.

Isosoma minor.

Dicyclus Amage, mas. *Viridi-æneus*, abdomine purpureo, antennis nigris, pedibus piceo-fulvis, femoribus æneis, alis limpidis.

Head and chest convex, bronze, finely shagreened: head large,

much broader than the chest, green towards the mouth; jaws ferruginous; eyes and eyelets dark piceous; feelers black; first joint piceous, tawny at the base: chest nearly elliptical: fore-chest short, much rounded in front; its length not more than one-fourth of its breadth: shield of the mid-chest rather short; sutures of the parapsides very indistinct; axillæ parted by one-fourth of the breadth of the chest; scutcheon truncate-conical, rather large: hind-chest well developed, obconical, declining, brassy green, with a ridge along the middle and a rim on each side, where there are also a few white hairs: petiole short and very slender: abdomen flat, smooth, shining, purple, bright coppery green at the base, a little longer than broad; metapodeon occupying more than one-third of the back, its hind-border convex; octoon not half the length of the metapodeon; ennaton shorter than the octoon; decaton as long as the ennaton; the following segments shorter: hips and thighs brassy; trochanters and shanks piceous; knees and feet tawny, tips of the latter piceous; fore-shanks and fore-feet brown: wings colourless; veins pale brown; ulna about half the length of the humerus; radius a little longer than the ulna; cubitus shorter than the ulna, slightly curved; brand dark brown, of moderate size. Length of the body 1 line; of the wings 2 lines.

Dicyclus nigro-æneus.

Pachyneuron formosum.

Pteromalus Carinus, mas. *Æneo-viridis, abdomine purpureo flavo maculato basi æneo-viridi, antennis nigris, pedibus flavis, metafemoribus fulvis, alis limpidis, proalis fusco maculatis.*

Bright green, with a very slight brassy tint: head and chest convex, shining, finely shagreened: head a little broader than the chest; front vertical: eyes and eyelets red: feelers black, slender, subclavate, as long as the chest; first joint long, slender, tawny; second cup-shaped, piceous, tawny at the tip; third and fourth very short; fifth and the following joints to the tenth successively decreasing in length and increasing in breadth; club elliptical, rather broader than the tenth joint and a little more than twice its length: chest nearly elliptical: fore-chest short, narrower in front; its length less than one-fourth of its breadth: shield of the mid-chest broader than long; sutures of the parapsides very indistinct, approaching each other till they reach the hind-border, where they are separated by one-sixth of the breadth of the chest; axillæ rather large, separated by somewhat less than one-third of the breadth of the chest; scutcheon nearly conical, truncate in front, with a rim along its hind-border, a little more convex than the shield; hind-scutcheon visible but very short: hind-chest obconical, declining, with an indistinct suture along the middle and a rim on each side: petiole very short, not one-fourth of the length of the hind-chest: abdomen nearly conical, a little narrower and much shorter than the chest, depressed, smooth, shining, dark purple, with a large pale yellow spot near the base which is brassy green; metapodeon occupying about one-third of the back; octoon

and following segments of moderate and nearly equal size : legs yellow ; hips brassy green ; hind-thighs and tips of feet dull tawny : wings colourless, rather broad ; a large brown spot occupying most of the disc of each fore-wing ; veins tawny ; ulna rather more than half the length of the humerus ; radius a little longer than the ulna ; cubitus much shorter than the ulna ; brand large, piceous. Length of the body $\frac{3}{4}$ line ; of the wings $1\frac{1}{2}$ line.

Pteromalus Anaxis, mas. *Viridis, abdomine purpureo basi viridicupreo, antennis nigris, pedibus flavis, femoribus piceo-viridibus, alis limpidis.*

Head and chest convex, very finely shagreened, bright green : head large, broader than the chest, with a broad shallow furrow extending from the eyelets to the base of the feelers : eyes and eyelets piceous : jaws ferruginous : feelers black, filiform, as long as the head and the chest ; first joint long, slender, very slightly curved, tawny from the base to the middle and piceous thence to the tip ; second also piceous and shining ; third and fourth extremely minute ; the following from the fifth to the tenth successively decreasing in length ; club linear, pointed at the tip, a little more than twice the length of the tenth joint : chest nearly elliptical : fore-chest very short, its length hardly one-sixth of its breadth : shield of the mid-chest of moderate size, its disc rather flat ; sutures of the parapsides indistinct ; axillæ parted by one-fourth of the breadth of the chest ; scutcheon truncate-conical, more convex than the shield : hind-chest well developed, obconical, declining, with a ridge along the middle : petiole very short, coppery : abdomen long-elliptical, greenish coppery, smooth, shining, nearly flat, dark purple on the disc, very little shorter but much narrower than the chest ; metapodeon occupying nearly half of the back, bright green towards the base, where it is concave ; octoon not half the length of the metapodeon ; ennaton shorter than the octoon ; decaton as long as the octoon ; the following segments very short : sexual parts long, pale tawny : legs very bright yellow ; hips green ; thighs piceous tinged with green, which dark colour as usual prevails most in the hind-legs and least in the fore-legs ; fore-feet tawny ; four hinder feet brown, first joint yellow : wings colourless ; veins piceous ; humerus twice the length of the ulna ; radius as long as the ulna ; cubitus very nearly as long as the radius ; brand of moderate size. Length of the body 1 line ; of the wings 2 lines.

Pteromalus Scopas, mas. *Æneo-viridis, abdominis disco purpureo, antennis fuscis, pedibus fulvis, femoribus viridibus, tibiis fusco fasciatis, alis limpidis.*—Fem. *Abdominis disco cupreo, antennis piceis, tibiis piceis, tarsis flavis.*

Head and chest convex, finely shagreened : head green, a little broader than the chest : eyes and eyelets red : feelers brown, filiform, rather stout, a little shorter than the head and the chest ; first joint piceous, linear, very slightly curved, tawny at the base ; second also piceous and shining ; third and fourth extremely minute ; the follow-

ing from the fifth to the tenth successively but very slightly decreasing in length; club long-conical, a little more than twice the length of the tenth joint: chest oval, brassy green, rather narrower towards the hind part: fore-chest very short, its length not more than one-eighth of its breadth: shield of the mid-chest broad; sutures of the parapsides very indistinct; axillæ parted by full one-fourth of the breadth of the chest; scutcheon truncate-conical, rather long: hind-chest of moderate size, obconical, abruptly declining, nearly smooth, with a ridge along the middle and a rim on each side: petiole extremely short: abdomen spindle-shaped, flat, smooth, shining, green, dark purple on the disc, bright coppery green at the base, shorter and much narrower than the chest: metapodeon occupying near half the back; octoon not one-fourth of the length of the metapodeon; ennaton longer than the octoon; decaton a little shorter than the ennaton; the following segments very short: sexual parts long, tawny: legs tawny; hips and thighs green, tips of the latter yellow; trochanters piceous; a broad brown band across each of the four hinder thighs; four hinder feet pale tawny with piceous tips: wings colourless; veins tawny; humerus more than twice the length of the ulna; radius a little longer than the ulna; cubitus shorter than the radius; band small.

Fem. Head and chest green, with a slight brassy tinge: head bluish green behind, rather broader than the chest: feelers clavate, piceous, shorter than the head and chest; first joint green, tawny at the base; the joints from the fifth to the tenth successively increasing in breadth and decreasing in length; club short-conical, broader than the tenth joint and full twice its length: abdomen oval, a little broader but not longer than the chest; bright green with the disc bronze, slightly compressed at the tip, concave above, very deeply keeled beneath, where it forms an angle whence it rises to the tip, which is much elevated, metapodeon occupying less than one-fourth of the back, its hind-border convex; octoon not half the length of the metapodeon; each of the three following segments as long as the octoon; paratelum shorter; telum longer; these segments are of more equal length beneath, where two or three ventral segments are visible towards the base of the abdomen: legs yellow; hips and thighs green; tips of the latter yellow; trochanters dark tawny; fore-shanks and fore-feet tawny; four hinder shanks piceous with yellow tips; four hinder feet with piceous tips: veins of the wings pale tawny; band brown. Length of the body $1-1\frac{1}{2}$ line; of the wings $2\frac{1}{4}-2\frac{1}{2}$ lines.

Pteromalus Calamis, mas et fem. *Æneo-viridis*, abdomine *purpureo*, *antennis nigris*, *pedibus fulvis*, *femoribus* *mari piceis* fem. *obscure fulvis*, *alis limpidis*.

Body convex: head and chest extremely finely shagreened: head bluish green, rather large and thick, a little broader than the chest: eyes and eyelets piceous: feelers black, very slightly subclavate, nearly as long as the head and the chest; first joint long, slender, linear tawny; second long cup-shaped; third and fourth extremely minute;

the following joints from the fifth to the tenth nearly equal in length but slightly increasing in breadth; club long-conical, hardly broader than the tenth joint, but more than twice its length: chest nearly elliptical, brassy green: fore-chest rather short, its length about one-fourth of its breadth: shield of the mid-chest rather short; sutures of the parapsides very indistinct; axillæ large, parted by about one-sixth of the breadth of the chest; scutcheon conical, coppery, rather prominent; hind-scutcheon very short, but visible: hind-chest well developed, obconical, declining, with a ridge along the middle and a rim on each side: petiole very short: abdomen nearly round, smooth, shining, purple, about half the length of the chest; metapodeon blue with a copper tinge at the base; octoon and ennaton of moderate size; the following segments extremely short, hardly visible: sexual parts long, pale: legs tawny; hips green; thighs piceous; knees yellow; four hinder feet pale tawny with piceous tips: wings colourless; veins pale brown; ulna much shorter than the humerus, but more than half its length; radius much shorter than the ulna; cubitus a little shorter than the radius, and rather more than half the length of the ulna; brand very small.

Fem. Head and chest dull green: head very little broader than the chest: feelers subclavate, shorter than the head and chest; first joint tawny; second piceous; third and fourth tawny; the following joints from the fifth to the tenth successively decreasing in length and increasing in breadth; club elliptical, broader than the tenth joint and nearly thrice its length: scutcheon dull coppery; abdomen long obconical, smooth, shining, dull purple, as long and rather broader than the chest, keeled beneath, and having there an angle whose hinder line rises abruptly from the middle to the tip; metapodeon bright green, concave at the base, nearly one-fourth of the length of the abdomen; the following segments successively and slightly decreasing in length: legs tawny; hips green; thighs dark tawny; four hinder feet pale tawny with piceous tips. Length of the body $\frac{2}{3}$ —1 line; of the wings $1\frac{1}{4}$ — $1\frac{1}{2}$ line.

Allied to *Pt. hemipterus*, *apicalis*, and *conifer*.

Cerchysius Euphranor, fem. *Æneo-viridis*, *abdomine cupreo apice purpureo*, *antennis nigris*, *pedibus fulvis*, *metapedum tibiis apice femoribusque piceis*, *alis limpidis*.

Head nearly semicircular, convex in front, slightly concave behind, green, coarsely shagreened, hardly as broad as the chest: eyes and eyelets dark red: feelers subclavate, black, a little shorter than the body; first joint long, subclavate; second cup-shaped; the following joints successively increasing in breadth; club long-conical, broader than the eighth joint and much more than twice its length: chest short, elliptical, convex, finely shagreened: fore-chest extremely short, hardly visible above: shield of the mid-chest short and broad; axillæ meeting on the back; no traces of the sutures of the parapsides; scutcheon obconical, brassy, flat, more roughly shagreened than the shield; its fore-border forming an obtuse angle: hind-chest very short, smooth, shining, purplish black: abdomen oblanceolate,

coppery, smooth, shining, concave above, deeply keeled beneath, compressed at the tip which is bright purple, a little longer but very much narrower than the chest; metapodeon occupying full one-third of the back; octoon and following segments short: legs tawny; middle legs paler than the fore-legs and dilated as usual; tips of their feet brown; hind-legs piceous; their shanks tawny with piceous tips: wings narrow, nearly colourless except their tips, which are gray; veins piceous; ulna about one-third of the length of the humerus; radius much longer than the ulna; cubitus shorter than the ulna, and forming with the radius a more acute angle than occurs in *Encyrtus*; brand extremely small. Length of the body $\frac{1}{2}$ line; of the wings $1\frac{1}{4}$ line.

Eulophus Amempsinus.

Tetrastichus flavifrons, fem. *Nigro-viridis, capite fulvo, abdomine nigro-purpureo, antennis fuscis, pedibus fulvis, metafemoribus piceis, alis limpidis.*

Body smooth, shining: head tawny, broad, very short, impressed between the eyes, bright yellow and somewhat dilated about the region of the mouth, a little broader than the chest: eyes and eyelets bright red, the former prominent: feelers pale brown, subclavate, rather stout, more than half the length of the body; first joint long, dilated; second tawny, cup-shaped; the following joints from the third to the sixth successively increasing in breadth and decreasing in length; club long-elliptical, broader than the sixth joint and more than twice its length: chest short-elliptical, convex, greenish black, rather broad: fore-chest very short, its length not more than one-tenth of its breadth: shield of the mid-chest large; sutures of the parapsides very distinct and strongly marked, converging towards the hind-border of the shield; axillæ parted by one-third of the breadth of the chest; scutcheon short, obconical, with two parallel sutures along its back: hind-chest short and broad, hardly narrower behind: petiole extremely short, so that the abdomen appears sessile: abdomen short-elliptical, flat, purplish black, a little shorter and narrower than the chest; metapodeon and three following segments of moderate length; the rest very short: oviduct pale tawny: legs pale tawny; tips of feet brown; hind-thighs mostly piceous: wings broad, colourless, pubescent, ciliated; veins pale tawny; ulna much longer than the humerus; radius shorter than the ulna; cubitus not one-third of the length of the radius; brand extremely small. Length of the body $\frac{1}{2}$ line; of the wings $1\frac{1}{3}$ line.

Tetrastichus Silius, fem. *Nigro-æneus, antennis fulvis basi piceis, pedibus fulvis, femoribus piceis, alis limpidis.*

Body smooth, shining: head black, broad, very short, impressed between the eyes, very little broader than the chest: eyes and eyelets bright red, the former prominent: jaws ferruginous: feelers dull tawny, subclavate, rather more than half the length of the body; first joint piceous; second cup-shaped; the following joints from the

third to the sixth successively increasing in breadth and decreasing in length; club long-elliptical, broader than the sixth joint and more than twice its length: chest short-elliptical, convex, brassy, rather broad: fore-chest very short; its length not more than one-tenth of its breadth: shield of the mid-chest large; sutures of the parapsides very distinct and strongly marked; axillæ parted by one-third of the breadth of the chest; scutcheon short, obconical, with two parallel sutures along its back: hind-chest short, broad, obconical, declining: petiole extremely short: abdomen long-elliptical, flat, bronze-black, slightly concave above, slightly keeled beneath, shorter and much narrower than the chest; metapodeon and three following segments of moderate length; the rest very short: legs pale tawny; tips of feet brown; thighs mostly piceous: wings broad, colourless, pubescent, ciliated; veins pale tawny; ulna much longer than the humerus; radius shorter than the ulna; cubitus not one-third of the length of the radius; brand extremely small. Length of the body $\frac{1}{3}$ line; of the wings $1\frac{1}{4}$ line.

Var. β. Body black.

XXII.—*Some Account of the storm of January in Bedfordshire.*

By JOHN MARTIN, Esq.

To the Editors of the Annals of Natural History.

GENTLEMEN,

Froxfield, Feb. 14th, 1849.

A REMARKABLE storm took place on Sunday the 14th of January 1849. A few particulars relating to it may be found interesting to those who attend to meteorological pursuits.

The information with respect to it, in this communication, is chiefly confined to what occurred in the park of the Duke of Bedford, and is obtained from His Grace's land steward, Thomas Bennett, Esq.

The hurricane, attended by a heavy fall of rain, passed over Woburn Park about half-past two o'clock P.M. The direction it took was from the north-west to south-east; its range did not appear to extend more than a quarter of a mile. The writer of this, who resides at the edge of the park, scarcely half a mile from the principal scene of destruction, was not aware of what was going on so close to him. The sun was shining a few minutes previously, and although the wind blew rather strongly, yet not perceptibly stronger than it had been blowing for some days.

Its greatest violence did not continue more than a quarter of an hour. As far as information has been obtained as to its appearance in this vicinity, it was first observed at Fenny Stratford and Bow Brickhill on the borders of Bedfordshire. At these places several trees were thrown down as well as many old buildings. On Bow Brickhill Heath, where there is a large fir

plantation of the Duke of Bedford's, several fir-trees were rooted up; the destructive effects of the storm may be tracked, through that and an adjoining plantation on Wavendon Heath, to the Fuller's-earth Lodge on the high road to Northampton. From this place to Woburn Park there was no obstruction offered to its progress. It attacked the evergreens in a plantation at Crawley Grange near the gate of some water-meadows on the west, and continued from thence to Crawley Grange plantations on the east. Several very large trees were uprooted by the violence of the wind, principally spruce fir, and many others broken in the middle by their fall. It then took the course of a hollow in a plantation of evergreens in Crawley Dean Hills, clearing away all that resisted its progress—passing over the open part without causing much damage. At Flitwick, about five miles distant, a windmill was blown down, its cap and sails destroyed—half of one of the latter was carried sixty yards before it fell, and then rebounded ten yards further. One of the flaps, made of iron and canvas, was blown to a distance of one hundred yards from the mill. Several houses and barns in the village were untiled. The storm then appears to have passed off in the direction of Hitchin, on the borders of Hertfordshire. Its fury however appears in a great measure to have been spent on the plantations of the Duke of Bedford, in the park and its vicinity.

The number of trees blown down and broken on this property is about five hundred. The principal damage was to the fir tribe, and this is perhaps to be accounted for from their leaves holding the wind, offering an obstacle to the gale, while the leafless state of oaks, beeches, and other timber presented in this respect no resistance.

A person who was on his way to Brickhill describes the violence of the storm to have been so great, as to force up the gravel on the road, and carry thorn bushes between two and three hundred yards. Several trees were blown down near him; the window-shutters of a house torn off; and all this destruction is stated not to have occupied more than a minute and a half. It was accompanied by a torrent of rain. A young man who was going from Crawley to Woburn encountered the storm. Rain not falling when he left home, he had not provided himself with any defence from what he did not anticipate on starting; he states that he had not proceeded more than ten minutes on his way, on arriving at the corner of the park wall on the road from Ampt-hill to Woburn, when his clothes and hat were entirely soaked through by a most heavy rain. In endeavouring to pass along the foot-path which runs close under the wall, it was with the utmost difficulty, owing to the violence of the storm, that he could maintain his footing; indeed it was so violent as to compel

him to retrace his steps. He had reached on his way back the corner of the wall close to the fir plantation in the Grange Belt, which he had only passed a few minutes previously, when he saw the whole clump of trees growing at the corner simultaneously laid prostrate. The action of the wind appeared to him to heave them up; in all probability, the blast, acting under the greater and lower branches, raised them in this manner. He describes the air around him as being darkened with the young shoots of the trees, mingled with thatch from haystacks in the adjoining fields; the roar of the storm was so great as entirely to drown the sound of the falling timber, although he stood so close to the scene of its fury. A gig with three persons in it had only passed a few seconds previously; though conscious that trees were falling, they did not actually witness them; it was with the utmost difficulty that the horse kept its legs, and the weight alone of the three prevented the vehicle itself from being blown over.

At the lodge called the Deans there is a very fine Weymouth pine; the keeper describes this tree as appearing to shiver to its very base, seemingly heaving up, as though underground action was at work; happily for the security of the cottage it rode out the storm.

A person residing at Castle Thorpe, two miles south of Hanslope in Northamptonshire, states that the day was remarkably clear till half-past one, when he distinctly saw the storm-cloud rise from the west and overspread the sky in a quarter of an hour and proceed eastward.

From information obtained through the kindness of a friend, it appears that the storm was observed at Bristol between twelve and one, and rather later at Cheltenham; its course is not known to me thence until it arrived at Fenny Stratford, Bow Brickhill and Woburn Park—at Bishops Stortford and Colchester it was noticed at about three o'clock. It most probably swept across the island, rising in the British Channel and terminating in the German Ocean. On reference to the map, it appears to have assumed a semicircular shape, agreeably to the law laid down by Col. Reid in his very interesting record of facts in his work upon that subject.

Some of your correspondents may have noticed its progress in other localities, and thus more effectually complete the course it took, and more decidedly establish in this instance the value of Col. Reid's theory.

The remarks with which I trouble you were intended principally to describe the effects of the storm in the Duke of Bedford's Park, where, from all that has been collected during its progress, the chief injury was sustained.

I am, Gentlemen, your obedient servant,

JOHN MARTIN.

XXIII.—*Descriptions of five new species of Coleoptera.*

By the Rev. J. F. DAWSON, LL.B.

Section GEODEPHAGA.

Fam. HARPALIDÆ, MacLeay.

Genus *Amara*, Bon.

1. *Amara Vectensis*. Oblonga convexa ænea nitida, interdum cæruleo-nigra: elytris punctato-striatis: antennarum articulis tribus primis rufo-testaceis: tibiis tarsisque rufo-ferrugineis. Long. $4\frac{1}{2}$ lin.

Oblong convex, body beneath shining black: head, thorax and elytra brassy brown, sometimes greenish brass, rarely blue-black, not always concolorous: thorax with an oblong deep impression on each side at the base, midway between the hinder angles and the dorsal furrow: elytra regularly and evenly striate, the striæ deepening towards the apex and finely punctured for about two-thirds their length, the punctures gradually diminishing behind the middle and totally ceasing when the striæ begin to deepen: within the outer margin an irregular line of deep impressions most numerous behind the middle: thighs pitchy black: tibiæ and tarsi rusty red or pitchy testaceous; anterior tibiæ with the spine at the apex tricuspid, the middle mucro being longest and stoutest and slightly curved, the inner one smallest: first, second, third and basal half of the fourth joints of the antennæ red, the rest fuscous black.

Originally taken at Ryde, Isle of Wight, and referred incorrectly to *tricuspidata*, Dej. We are indebted to Dr. Schaum for correcting this error; and his opinion has since been confirmed by other continental entomologists, who have pronounced it to be an undescribed species. I have taken it annually for some years past in the north side of the Isle of Wight, but always sparingly, except on one occasion, when in company with my friend Mr. Wollaston (April 1846), it occurred plentifully among refuse left by a flood at Ryde. I have not seen it since. As the species requires a name, I have given it one commemorative of the locality in which it is (I believe *exclusively*) found.

Genus *Trechus*, Clairville.

2. *Trechus incilis*. Subtus niger, abdominis apice testaceo, supra nigro-piceus, thorace cordato, convexo, postice angustato, utrinque foveolato, angulis posticis incilis, acutis: elytris oblongo-ovatis, striis quatuor dorsalibus abbreviatis in singulo impressis: antennarum 2, 3 et 4 articulis nigris, reliquis, palpis pedibusque testaceis. Long. $2\frac{1}{4}$ lin.

Oblong ovate, dusky pitchy: head with two oblong frontal impressions: thorax heart-shaped, disc convex, broad in front,

with the sides considerably narrowed towards the hinder angles, which are acute, having a large fovea on each side nearly covering the base: elytra rather convex, *the disc of each with three rugged abbreviated striæ, and a fourth interrupted and somewhat obsolete*; sides and apex smooth, with four or five impressions within the margin, near the humeral angles: body beneath shining black, with the tip of the abdomen broadly testaceous: antennæ (except the second, third and fourth joints which are black), palpi and legs red.

A pair, taken by myself in July 1847 at Whittlesea Mere, are the only specimens known.

Genus *Blemus*, Zeigler.

3. *Blemus lapidosus*. Rufo-testaceus, nitidus, capite interdum piceo, oculis nigris: elytris punctato-striatis, punctisque duobus impressis, palpis pedibusque pallidis. Long. $2\frac{3}{4}$ lin.

Above reddish testaceous, paler beneath: head with a deep longitudinal stria on each side: thorax somewhat heart-shaped, having a deep fovea on each side at the base: elytra depressed, deeply striate, the striæ finely punctate, third interstice with two deeper impressions: legs and palpi pale.

Taken on the south coast of England some years ago, and erroneously referred to *pallidus*, Sturm. It appears to have been a scarce species, as I never saw a specimen in any collection till I had the good fortune to rediscover it about five years ago on the south coast of the Isle of Wight. Dr. Schaum, in his remarks on the British *Carabidæ* published in the Stettin Transactions*, has stated that it "answers perfectly to the description of *Trechus fulvus*, Dej.;" but in a letter which I received from him shortly after his last visit to England, he observes, in reference to specimens which I had given him, "It is not *Trechus fulvus*, Dej., as I supposed: the latter, of which I have lately seen a typical specimen, is allied, but sufficiently distinct: *Trechus pallidus*, Sturm., being equally distinct: your insect ought to receive a new name." I have assigned it one, indicative of its habitat, being found at some depth among the fine shingle on the sea-beach. It is taken also in similar situations in the north of England by Messrs. Hardy and Bold, but is very local.

Fam. BEMBIDIIDÆ, Stephens.

Genus *Peryphus*, Megerle.

4. *Peryphus neglectus*. Supra viridi-æneus, thorace cordato angustato, utrinque foveolato, angulis posticis acutis: elytris oblongis, paululum depressis, punctato-striatis rufo-piceis, fasciis duabus fere obsoletis rufo-testaceis: antennarum 1, 2, 3 et 4 articulis, pedibusque testaceis. Long. $2\frac{1}{2}$ lin.

[* See also 'Annals,' p. 37, of the present volume.—Ed.]

Beneath black : head and thorax dark metallic green, shining, the former with a broad frontal impression on each side behind the eyes, back of the head smooth and glabrous : mandibles pitchy : palpi testaceous with the apex pitchy : first, second, third and basal half of the fourth joints of the antennæ red, the rest fuscous black, all the joints (except the second) rather long : thorax convex, heart-shaped, narrow, not much more than half the width of the elytra at the base, which has a deep fovea on each side, hinder angles acute : elytra oblong, rather wide and depressed, the sides somewhat parallel, with the tip gently rounded, coarsely punctate-striate, with two deeper impressions on the third stria ; the apex smooth, pitchy red, with two reddish testaceous fasciæ more or less obscure and obsolete, sometimes wholly wanting : legs testaceous red.

Not unfrequent in the north of England on the banks of the Tyne and Derwent, and mentioned in the ' Catalogue of the Insects of Northumberland and Durham ' as a variety of *saxatilis* by Mr. T. J. Bold, to whom I am indebted for my series. It is however sufficiently distinct from that species ; for independently of the colouring the structure is different, and while the elytra are considerably broader and perhaps less depressed, and the punctured striæ *not* carried to the apex, as they are in *saxatilis*, at the same time the thorax is smaller, narrower in front and more convex. Dr. Schaum, whose attention I called to the species, after a careful examination and comparison of the specimens which I had given him with their continental allies, both at Paris and Brussels, informed me that it is unknown.

Genus *Lopha*, Megerle.

5. *Lopha Clarkii*. Supra nigro-picea, thorace subcordato, truncato, utrinque foveolato : elytris oblongo-ovatis, punctato-striatis, punctis sat profundis : antennarum basi, pedibusque testaceis. Long. $1\frac{3}{4}$ lin.

Beneath shining black, above pitchy black, head with two slightly flexuous striæ, between which is an elevated ridge, on each side behind the eyes somewhat approximating in front : mandibles pitchy red, palpi pitchy black, basal joint of the antennæ wholly and base of some of the following ones pale red : thorax oblong heart-shaped, truncate before and behind, disc convex, transversely wrinkled, with the sides dilated and rounded before the middle, then narrowed, but leaving the base sufficiently broad, which has a large rugged fovea on each side, hinder angles acute : elytra oblong-ovate, wide, convex, deeply punctate-striate, the punctured striæ abbreviated before the apex, which with the sides is smooth, and has an obsolete blood-red spot near the outer margins : legs entirely red. In its general struc-

ture and in the deep punctures on the elytra it is allied to *Manerheimii*, but is a larger and more robust insect; the thorax especially is much larger and broader at its basis.

I captured three specimens near Dorchester in May 1848, a pair of which I gave to Dr. Schaum, who informed me by letter after his return to Germany, that the species is unknown on the continent.

Ramsgate, February 15, 1849.

XXIV.—*Algæ Orientales*:—*Descriptions of new Species belonging to the genus Sargassum*. By R. K. GREVILLE, LL.D. &c.*

[Continued from p. 109.]

[With a Plate.]

WIGHTIANÆ.

13. *Sargassum obovatum* (nob.); caule subcompresso; foliis caulinis obovatis, obtusissimis, subintegris vel obscure dentatis; aliis racemis intermixtis lanceolatis, serratis; vesiculis subellipticis; receptaculis minutis, oblongis, cylindraceis, in racemis densis, rotundatis, pedunculatis, aggregatis.

Hab. in mari Peninsulæ Indiæ Orientalis; Wight.

Root unknown. *Plant* probably 1–2 feet long, judging from the fragment in my possession, which is apparently a portion of one of the primary branches or divisions of the *stem*; this is somewhat compressed, as thick as a blackbird's quill, beset with numerous branches 2–3 inches long, which are bushy with ramuli less than an inch in length on which are found the racemes of fructification. *Leaves*: those on the stem above an inch long, obovate, quite rounded at the extremity, almost entire or obscurely repando-dentate, furnished with a nerve which disappears at some distance from the end; those on the smaller branches often more or less serrated, while those which accompany the fructification are much smaller, linear-lanceolate, and sharply serrate. *Vesicles* attaining the size of a small garden pea, varying in shape from elliptical to spherical, sometimes apiculate, supported on a compressed stalk generally little more than a line in length. Sometimes, however, one of the little lanceolate leaves becomes converted into a vesicle, and the stalk is then proportionally long. *Receptacles* cylindraceous, oblong, much-divided and lobed, forming a dense, roundish, very shortly pedicellated cluster a line or more in length. *Colour* very dark red-brown. *Substance* thick and cartilaginous.

* Read before the Botanical Society of Edinburgh 11th Jan. 1849.

The only specimen—and it is a mere fragment—which I have seen of this Alga was disentangled from some other species. There appears to be a disposition in the leaves towards the ends of the branches to become incurved, but this may not be a permanent character.

14. *Sargassum Wightii* (nob.) ; caule compresso, distiche ramoso ; foliis anguste lanceolatis, integerrimis ; vesiculis ellipticis, apiculatis, longe petiolatis, petiolis planis, dilatatis ; receptaculis linearibus, compressis, ramosissimis, in racemo amplo subtruncato aggregatis.

Wight in herb. no. 12 & 13.

Hab. in mari Peninsulæ Indiæ Orientalis ; Wight.

Root an expanded disc, throwing up several mostly undivided stems from 1 to 2 feet in length, or probably more, giving off branches in a distichous manner, at intervals of half an inch or more ; the lower ones are several inches long, becoming gradually shorter, and more remote as they approach the summit : the fruit-bearing ramuli are very short, and, like the rest, distichously arranged. *Leaves* from 1 to near 2 inches in length, narrow-lanceolate, sometimes almost linear-lanceolate, nearly equally attenuated at each extremity, acute, quite entire or obscurely repando-dentate, furnished with a somewhat faint nerve and a few scattered pores. *Vesicles* about the size of the seed of *Lathyrus odoratus*, elliptical, apiculate, on long dilated foliaceous stalks, in young plants arising from the axils of the cauline leaves ; afterwards accompanying the fructification but sparingly, and generally taking the place of a leaf. *Receptacles* axillary, filiform, compressed, very much divided, the exterior branches the longest, so that the racemes have a cymose or tassel-like appearance. The racemes vary much in size, being dense, and not more than 2 or 3 lines long in some plants ; in others half an inch and much more lax. *Colour* dark, olivaceous, the receptacles black when dry. *Substance* slightly cartilaginous.

In some specimens, the branches, besides producing axillary racemes, have the appearance of terminating in a larger raceme, an effect which seems to be produced by the ultimate leaves being converted into receptacles, the whole preserving the truncate and tassel-like outline of the axillary racemes.

For this fine and very striking Alga I have reserved the name of the excellent and indefatigable naturalist from whom I received it. It is quite unlike any other species with which I am acquainted.

15. *Sargassum cervicorne* (nob.) ; caule compresso, distiche ramoso ; foliis late lineari-lanceolatis subintegerrimis, superioribus atque in ramis fertilibus brevioribus, lanceolatis, plus minusve dentatis ;

vesiculis elliptico-sphæricis petiolatis, petiolis foliaceis, dilatatis; receptaculis compressis, valde dentatis, in racemo composito aggregatis.

Wight in herb. no. 17.

Hab. in mari Peninsulæ Indiæ Orientalis; Wight.

Root a callous disc, throwing up a number of *stems* nearly two feet long, compressed, a line or more broad, undivided, giving off *branches* in a distichous manner, at intervals of from half an inch to an inch or more, 3–6 inches long, spreading, the whole forming a more or less oblong outline. Fruit-bearing *ramuli* numerous, an inch long or more at the base of the branches, and diminishing gradually to the extremity. *Leaves*: those produced from the main stem and especially on young plants often 2 to near 3 inches long, and from a quarter to half an inch in breadth, somewhat obtuse at the apex, either quite entire or obscurely repando-dentate, rarely furnished with a few sharp teeth towards the base. On the branches they are about an inch long, more or less lanceolate, more acute, often sharply toothed; all furnished with a nerve and pores. *Vesicles* somewhat elliptical, on young plants nearly as large as a small garden pea, supported on foliaceous, dilated stalks 2–3 lines long. Sometimes the vesicle is winged and apiculate. *Receptacles* 1–1½ line long, axillary, forming pedunculate, more or less divided racemes, the segments very irregular in shape, compressed, and toothed so as frequently to resemble a deer's horn.

The most remarkable feature in this *Alga* is the occasional length of the leaves which arise at the base of the primary branches, and which cause them to resemble the fronds of some of the Lycopodoid *Polypodia*. This is most conspicuous in a rather early stage of growth. The species however is liable, I suspect, to considerable variation; and even on the same individual leaves may be seen almost, if not quite entire, while others are decidedly and sharply toothed. The latter occur chiefly in the upper part of the plant, and towards the ends of the branches. The description and figure I have given must be regarded as provisional, for if my apprehensions be well-founded, a more extensive series of specimens will be required before a complete character can be drawn up.

EXPLANATION OF PLATE IX.

Sargassum obovatum.

Fig. 1. Termination of a branch.

— 2. Cauline leaf.

— 3. Leaves accompanying the receptacles.

— 4. A raceme and leaf from the end of a branch.

— 5. Vesicles. 4 magnified.

Sargassum Wightii.

Fig. 1. Portion of a branch.

- 2, 2. Leaves and vesicles from a young specimen.
- 3. Raceme of fructification as sometimes seen terminating the branches.
- 4. Portion of a raceme in its more compact form.
- 5. Portion of do. as seen in fig. 3.
- 6. Vesicle. 4 & 5 magnified.

Sargassum cervicorne.

Fig. 1. One of the fertile ramuli, and leaf given off at the base of a branch.

- 2. Leaf from a young plant with vesicles.
- 3. Do. from towards the upper part of same plant.
- 4. Vesicles.
- 5. Receptacles as they are developed on one specimen.
- 6. Do. The last magnified.

XXV.—On the *Gonidia* of Lichens. By G. H. K. THWAITES, Lecturer on Botany and Vegetable Physiology at the Bristol Medical School.

[With a Plate.]

THERE appears to have been much uncertainty felt by those who have devoted their attention to the study of the Lichens, as to the real character of those spherical or subspherical green bodies which are characteristic of true Lichens, and to which the name of *gonidia* has been given, from the circumstance of their capability of becoming developed into new plants when separated from the parent structure. Every one who has examined carefully the *thallus* of a Lichen under a tolerably high power of the microscope, must have been struck by the peculiar appearance of the *gonidia*, as compared with ordinary cellular structure:—the frequent irregularity in their form—their want of correspondence in size—their slight attachment to each other, or to the filamentous tissue surrounding them, and their aggregation in certain parts of the structure—must have taken the attention of any observer who has been much accustomed to the examination of vegetable structures. These peculiarities indeed gave rise to a strong desire on my part to ascertain the real character of *gonidia*, and after examining a great number of species, both of true Lichens and of the genus *Collema*, and plants allied to it, I am able with confidence to state what is the true character of *gonidia*. It is pretty generally known that the *thallus* of *Collema* consists of a number of moniliform filaments, and also of delicate anastomosing cylindrical filaments immersed in a more or less firm gelatine. When examined more carefully the structure is found to consist of numerous Nostoc-like vesicles closely cohering, and among which ramify the anastomosing filaments. The cellular

cuticle which invests the *thallus* of some species of *Collema*, or rather of *Leptogium*, Fr., is a modification only of the anastomosing filaments, as can be proved from the structure of some allied plants.

What has just been stated may be considered a description of the ordinary structure of *Collema* and *Leptogium*, but in *Collema nigrum* we find each frond corresponding to a single nostoc-vesicle, which becomes invested with a cellular cuticle, and has external to this the characteristic anastomosing filaments, which, with those of other similar fronds, go to form the filamentous substratum or kind of thallus upon which the fronds of this species are situated. In the true Lichens is to be traced a very similar structure, only that instead of nostoc-vesicles we find groups of cells very nearly resembling those of the genus *Pleurococcus*, Meneghini, and around these cells, which increase in number by continual subdivision, anastomosing filaments or modifications of them become developed, just as takes place in *Collema nigrum*; indeed so great is the resemblance between the small fronds of that species and a state I have found of *Biatora vernalis*, as to have at first made me suppose they were immediately allied to each other.

From the above then it is clear, that the *gonidia* of a Lichen are the analogues as regards their functions of the nostoc-vesicles of *Collema*, and this view enables us to understand what previously appeared an anomalous character in these organs. The *gonidia* are in fact the *essential* part of the whole structure, and can scarcely be considered as *gemmæ*, except when under certain circumstances they put on that character, just as ordinary cells do in other plants.

The other elements of the Lichen-thallus may without difficulty be believed to represent modifications of the anastomosing filaments of *Collema*, which no doubt they are.

It is thus shown that between *Collema* and the true Lichens there subsists a close though not an immediate affinity, the essential part of the *former* being represented by the genus *Nostoc*, and of the *latter* by the genus *Pleurococcus*.

There are other plants bearing considerable external resemblance to those we have been describing, but which are represented, as respects their *essential* structure, by other genera of the lower Algæ. Among such may be mentioned *Synalissa vulgaris*, Fr., first gathered in this country by Mr. Borrer, who found it growing upon St. Vincent's Rocks: externally this little plant much resembles a *Collema*, but an examination of its internal substance under the microscope exhibits to us a structure very like that of the genus *Coccochloris*: a number of single cells (or binate, when undergoing subdivision) are scattered throughout

the gelatinous substance of the plant, and most thickly towards the periphery of the cylindrical branches of the fronds. Each cell is found, upon a careful inspection, to be surrounded by its definite amount of gelatine, and to be situated at the extremity of an ultimate ramification of the numerous somewhat anastomosing filaments which pervade the whole mass of the plant (Pl. VIII. A. fig. 2). The genus *Paulia*, Fée, a species of which (*Paulia perforata*, Mont. MSS.) has, at the request of Mr. Berkeley, been kindly sent for my inspection by Dr. Montagne, possesses an internal structure precisely similar in character to that of *Synalissa*. The asci of *Synalissa vulgaris* contain numerous perfectly spherical sporidia: I could not detect any apothecia in Dr. Montagne's specimen of *Paulia*. The genus *Lichina* is immediately allied to *Stigonema* (*Ephebe*, Fr.), and the whole structure is very different from that of *Paulia*, as I have ascertained from the examination of freshly-gathered specimens of the former recently sent me by Prof. Harvey.

Whilst writing on this subject, I may mention another very interesting plant, which, in the texture of its frond and character of its fructification, exhibits some analogy to *Collema*. I allude to *Mastodia tessellata*, Flor. Ant., for a sight of specimens of which I have been indebted to the kindness of Professor Harvey and Mr. Berkeley. The essential structure of this plant is represented by the genus *Ulva* (especially *Ulva crispa*), but it possesses apothecia containing asci, though the latter organs appear to have escaped the observation of the excellent botanists who described the plant, owing to the sporidia so soon becoming free.

We have thus then offered to our view plants which, judging from their external appearance alone, would be arranged together in one undivided group, and even in some cases in the same genus, exhibiting nevertheless totally different types of structure. They are as follows:—

1. The *Lichens* proper ;
2. *Collema*, *Leptogium*, &c. ;
3. *Synalissa* and *Paulia* ;
4. *Mastodia* ;

represented respectively, as regards their essential fundamental structure, by the genera *Pleurococcus*, *Nostoc*, *Coccochloris* and *Ulva* (*U. crispa*), which are usually placed very near together in a natural arrangement ; but the circumstance of their each impressing a character, upon being a bond of union, as it were, to plants higher in the scale of vegetation, will doubtless, if well considered, furnish a key to the proper arrangement of species closely allied to and of equally low development with them.

It is highly interesting to observe in these lower plants a typical character of essential structure binding together nume-

rous species of various forms, and enabling us to distinguish at once in other species resemblances of analogy from those of affinity: so true is it that in the smallest natural groups of organized structures the same great principles are to be discovered, when carefully sought for, which exhibit themselves so obviously in the larger divisions of the Kingdom of Nature.

EXPLANATION OF PLATE VIII. A.

- Fig. 1.* Portion of a plant of *Synalissa vulgaris*, Fr., slightly magnified.
 — 2. Small portion of the internal substance of the frond, showing the arrangement of the cells, and their attachment to the branched filaments. Magnified 270 linear.
 — 3. Asci and paraphyses of *Synalissa vulgaris*. Magnified 270 linear.

BIBLIOGRAPHICAL NOTICES.

Illustrations of the Proceedings of the Zoological Society of London.
 Part I. January—April. 1848. 8vo.

WE hail with hearty welcome this most noble addition to the illustrated periodical zoological works of our country, and hope that it may meet with that liberal encouragement which will induce Mr. Mitchell, the able Secretary to the Zoological Society, to persevere in its publication. It is really a very handsome work, and independently of its scientific value, we must say that to the general lover of the works of an allwise Creator, this book must prove singularly pleasing. There is a very happy selection of subjects—something to please everybody.

Mammalia are represented in *Galidictis vittata*, J. E. Gray, well drawn and lithographed by Mr. B. W. Hawkins. This animal belongs to the same family as the weasels, and is described by Mr. Gray from a specimen in the British Museum, now so rich in its collection of mammalia.

Ptilocercus Lowii, J. E. Gray, drawn and lithographed by Mr. Wolf. A very beautiful and singular insectivorous quadruped, organized for an arboreal life by its singular pen-shaped tail, with its two vanes, so suited to balance the little creature; it was discovered by Mr. Hugh Low, Colonial Secretary, Borneo, in the woods of that island; we hope the enterprising Secretary of the Zoological Society may succeed in getting from Borneo live specimens of this and other zoological productions of the Indian Archipelago.

Of Birds there are figured *Coracopsis? personata*, G. R. Gray, a fine new species of Parrot, now in the noble collection of the Earl of Derby, President of the Zoological Society; it is figured by Mr. B. W. Hawkins.—*Trochilus (Helianthus) Mavors*, Gould. Mr. Richter has figured this and the next plate (our favourite) of these “children or messengers of the sun,” as some one has pleasingly named the Humming-bird,—*Trochilus (Helianthea) Eos*, Gould, a most gorgeous bird, and most admirably

figured and coloured : if Gould's forthcoming work on the *Trochilidae* is to have all the figures of a similar character and execution to this, we can assure him of almost certain encouragement.

Of Annulosa, Insecta,

Mr. Hewitson figures and describes a most beautiful species of Butterfly found by Mr. Charles Empson of Bath in South America ; it is the *Agrias Ædon* ; this figure is coloured in a most masterly way, and to the artist must prove valuable as showing the arrangement, harmony and contrast of colour, which are exhibited in insects, on birds and on shells, in particular, in a way which often surprises artists not accustomed to look to these objects. Mr. Hewitson's figures of the eggs of British birds and his illustrations of Doubleday and Hewitson's Genera of Diurnal Lepidoptera are well known.

Of Annulosa, Crustacea,

Mr. Gray figures two new species of Cirripeds, *Scalpellum ornatum* and *Anatifa ovalis*, while figures by Mr. William Wing of the *Lithodes (Echinocerus) cibarius*, White, a singular rough edible species of crab from the Columbia River, in the collection of the British Museum, are given in a most commendable way on stone ;—Mr. Wing bids fair to distinguish himself as a draughtsman of Crustacea, Insects, and Radiata.

Of Radiata

Mr. J. E. Gray figures *Sarcoptilus grandis*, a new genus and species in the collection of the British Museum ; it is a singularly interesting form of Radiata.

We have before us proofs of the plates that are to appear in Part II., and can only say they keep up amply the good character of Part I.

Mr. Gray's new species of Monkey, *Cercopithecus Pluto*, figured most graphically by Mr. Wolf.

Mr. Angas's new South African Antelope, described by Mr. Gray and named *Tragelaphus Angasii*, is shown in two excellent plates drawn by Mr. B. Waterhouse Hawkins ; it is a most lovely animal ; the male, female and young are represented.

Of Birds, the *Podica personata*, G. R. Gray, one of the Finfoot tribe, is figured by Mr. Wolf, and also a new Parrot, the *Psittacus Ruppellii*.

Of Insects, Mr. Hewitson figures the new Butterfly (*Corades Enyo*), while Mr. Doubleday's interesting new Australian Moth is figured with its fine larva, which will form a valuable addition to our knowledge of the history of Australian Lepidoptera. Mr. Wm. Wing has drawn and lithographed this plate.

The price of these illustrations can only cover the expenses of publication. We can most sincerely recommend the work to our readers, scientific and non-scientific : as plates of beautiful objects, admirably lithographed and most accurately coloured, they merit every praise ; as coloured prints for albums most of them would be sought after, if sold singly, at three times the price asked for them. They are good and cheap—rare qualities in combination.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

March 28, 1848.—Wm. Yarrell, Esq., Vice-President, in the Chair.

The following papers were communicated to the Meeting:—

1. DESCRIPTION OF A NEW SPECIES OF BUTTERFLY, OF THE GENUS AGRIAS. BY W. C. HEWITSON, M.E.S. ETC.

Genus AGRIAS, Boisd. MSS.

Head rather broad, clothed with hair; eyes nearly round or slightly oval, prominent; maxillæ rather longer than the thorax; labial palpi rather widely separated, ascending, thickly clothed with scales, which in front are long; basal joint curved, very short, second more than twice the length of the first; third short, pointed. Antennæ elongate, about three-fourths the length of the body, gradually thickening from the base to the apex.

Thorax large, elongate-ovate, truncate posteriorly, hairy. Anterior wings subtriangular, the anterior margin rounded, about one-half longer than the outer, which is nearly straight or slightly sinuate; the inner margin rather longer than the outer, straight. Costal nervure stout, extending beyond the middle of the costa; subcostal nervure throwing off its first nervule about the middle, the second a short distance before the end of the cell, the third at some distance beyond the cell, the fourth rather more remote from the third than that is from the fourth. Third subcostal nervule terminating at the apex; fourth running close to the third until near the apex, then bent downwards and reaching the outer margin about half-way between the apex and the termination of the fifth subcostal nervule; upper disco-cellular nervule very short, middle above twice the length of the upper, lower nearly twice the length of the two other combined; third median nervule considerably curved. Posterior wings obovate; the fold for the reception of the body ample, anterior margin rounded, outer slightly dentate, sinuate; precostal nervure simple; cell closed by a slight disco-cellular nervule.

Anterior feet of the female small, the femur and tibia about of equal length, the tarsus short, four-jointed, the basal joint longer than the rest combined, which are all short, transverse, and nearly equal. Middle and posterior feet stout, rather short; the tibiæ spiny within, the spurs very short; the tarsi spiny at the sides, the first joint spiny below also, equal in length to the rest combined; claws small, curved; pulvillus large.

Abdomen short, tapering.

AGRIAS *ÆDON*. *Ag. alis anticis suprâ latè chermesinis, apice marginæque interno nigro, posticis suprâ nigris plagâ magnâ, cyaned, subtus fuscescentibus, ocellis septem submarginalibus nigris, albo pupillatis.*

Exp. alar. 3 unc. 9 lin., vel 95 millim.

Hab. Nueva Granada.

Above, anterior wings rich crimson, the costal nervure and the inner margin fuscous black, the apex broadly and triangularly black, the black colour commencing on the costa opposite the end of the cell, becoming narrower towards the outer angle, where it unites with the fuscous black of the inner margin. Posterior wings black, marked with a large blue discoidal patch, extending nearly to the anal angle. Below, anterior wings with the part corresponding to the crimson of the upper surface much paler than above, the cell with two round black spots; the black of the apex and inner margin replaced by pale fuscous; the disco-cellular nervules marked with a fuscous black dash, and the apex crossed by two oblique bands of the same colour. Posterior wings pale fuscous, with two rounded fuscous spots in the cell; several scattered lituræ of the same colour before the middle of the wing, then two transverse bands also fuscous, followed by a series of seven black spots pupilled with white, the last bipupillate, the second spot the largest: between these spots and the margin a third fuscous band.

Head, thorax and abdomen black.

This beautiful butterfly is I believe unique in my own collection. It was taken by my friend Mr. Empson many years ago in South America, and was one of a very few things—all at that time very rare—which were saved from the shipwreck of a large collection.

Mr. E. Doubleday, whose experience gives him great facility, has kindly supplied me with the generic characters.

2. DESCRIPTION OF *ECHINOCERUS CIBARIUS*, A NEW SPECIES AND SUBGENUS OF CRUSTACEA. BY ADAM WHITE, F.L.S. ETC.

Amongst the Decapod Crustacea there are several genera of doubtful situation which belong to neither of the great divisions *Brachyura* and *Macroura*. Professor Milne-Edwards first brought them together as a section, under the name of *Anomoura*; but, as he remarks, they do not form a very natural group, the principal advantage derived from its formation being the opportunity which it gives the systematist to withdraw all the aberrant species from the two very natural sections specified above. Not a year passes but new species are added to this group, and occasionally a new form is found; in course of time these discoveries will serve to link genera which seem at present to be distant from each other, if at all related. The species described below is close to the genus *Lithodes*, some of the species of which have considerable resemblance to it. The generic name describes the peculiarity of the spined appendage to the outer antennæ, while the specific name is given in allusion to its excellence as an article of food.

In one of the two specimens in the British Museum, the legs, carapace and abdomen are covered with numerous barnacles, and on taking off the old carapace, which had commenced to split, the still coriaceous envelope, which would have formed the new carapace, may be found beneath it. On this are very plainly indicated the crowded warts, the scattered knobs, and lateral projecting spines, which are so prominent on the outer surface of the old carapace.

The different regions of the carapace are also clearly distinguished : the body of this new carapace is coriaceous ; the warts are more calcareous, and consist for the most part of small irregularly-shaped plates, arranged circularly round a small group of calcareous scales. These groups are of different sizes, from that of the head of a small pin to the space occupied by the top of a tolerably large nail. On a small portion of the carapace, on each side of the middle knob, and in two lines directed towards the front, there are distinct portions of calcareous matter already formed, while on the abdominal plates there are still more extensive calcareous portions formed in the corium ; the various groups of plates are distinctly visible, most of the scales are perforated, and through the holes in many cases a short hair or bristle protrudes. This new skin is only visible on the carapace and on the abdominal plates.

ECHINOCERUS (LITHODES) CIBARIUS.

Carapace considerably wider than long, subtriangular, very irregular above ; the front sinuated, with a large projecting pointed beak springing from the middle, and armed above with three or four spines arising from one knob ; the sinus on each side has three spines, the outer one very large and projecting ; edge of the carapace more or less spined all round, the spines on the latero-anterior ridges being sharp, those on the latero-posterior and posterior edges being blunt ; the latero-anterior and latero-posterior edges separated by a deep notch ; general surface of carapace closely covered with tubercles, which are perforated, and furnished with bristles springing from the holes ; on the stomachal region there is a high conical projection, the sides of which are comparatively smooth ; near the base of this on each side is a smooth somewhat oval wart, with an impressed line behind it ; on each branchial region a high conical projection, and another behind the middle of a straight line drawn between the branchial tubercles ; the posterior edge of the carapace with two rather large tubercles separated by a slight sinus.

Chelæ with the end of the fingers hollowed out somewhat like a spoon, the edges granulated, the hands with numerous large bristly pointed tubercles on the outside, three of these being on the upper edge ; the wrist with a large triangular expansion on the inside, which is spined and tubercled above ; second, third and fourth pairs of legs nearly as long as the first pair, and very similar in appearance, but not so thick ; the third joint from the tarsus flat on the sides ; the upper surface of the legs with large conical bristly tubercles or spines ; the spines on the tibial joint arranged in three longitudinal lines ; the tarsus spined, particularly on the lower edge ; fifth pair of legs quite concealed within the branchial cavities.

Outer antennæ with a large appendage at the base ; this appendage is smooth below, and has four longitudinal rows of spines on its upper portion, the lateral rows having the longest spines.

Inner antennæ situated beneath and to the outside of the eyes ; the first joint very thick, particularly at the base, subcylindrical ; second and third joints cylindrical, nearly equal in length, thickest at the tips.

Eyes close together, placed under the frontal spine; the peduncle is much shorter than, and not nearly so thick as, the basal joint of inner antennæ; the upper side covered with small spines.

Outer jaw-feet resemble those of *Lithodes*, especially in *L. brevipes*.

Abdomen very wide, rounded at the base, triangular at the end, formed of many plates of different sizes, which are close together; the basal segment is crescent-shaped, and within its sinus are included the other plates, which are arranged in four longitudinal series; the outer series narrow, the other three wide; the plates of different sizes and shapes, with two supplemental plates, one on each side of the central row, and at its base; the plates with rough and bristly tubercles; the first joint of abdomen with two round depressions, the base of each being coriaceous-like, and furnished with only a few small scattered calcareous tubercles; the middle of the hind-edge with four tubercles placed in pairs.

Hab. North America, mouth of the Columbia River; Sir George Simpson. In Mus. Brit.

3. DESCRIPTIONS OF NEW SPECIES OF TURBO, CHIEFLY FROM THE COLLECTION OF HUGH CUMING, Esq., F.L.S. BY LOVELL REEVE, F.L.S. ETC.

TURBO NATALENSIS. *Turb. testâ vix imperforatâ, orbiculari, depressiusculâ, anfractibus spiraliter sulcatis, sulcis regulariter concavis latiusculis; olivaceo-viridescente, rufo radiatim maculatâ et punctatâ, intûs argenteâ; operculo testaceo, cristato.*

Hab. Port Natal; Wahlberg.

The operculum of this beautiful species is a tufted mass, like that of the *T. sarmaticus*.

TURBO SAXOSUS. *Turb. testâ imperforatâ, ovatâ, spiræ suturis subprofundè impressis; anfractibus supernè concavo-declivibus, medio angulatis, transversim obscure liratis, tuberculis juxta suturas coronatis, infrâ nunc muticis, nunc tuberculis bi-tri-seriatim armatis, laminis subtilibus, longitudinaliter obliquis, peculiariter exsculptis; viridi albimaculatâ, intûs argenteâ; operculo testaceo, crasso.*

Hab. West Columbia; Cuming.

Having observed this species in a private collection, under the name *saxosus*, in manuscript, I adopt it, though not a very appropriate one, lest it may have been published and escaped my observation. The rows of tubercles are extremely variable, being even more prominently developed in specimens of smaller growth than is here represented.

TURBO LAMINIFERUS. *Turb. testâ umbilicatâ, ovatâ, spiræ suturis canaliculatis; anfractibus subtubulosis, spiraliter costatis, costis distantibus, et, cum interstitiis, pulcherrimè concentricè laminatis, aperturâ rotundâ; viridi, nigro longitudinaliter undatâ, intûs argenteâ.*

Hab. Mouth of the Victoria river, New Holland.

A very beautifully sculptured species, allied to the *T. Ticaonicus*, but perfectly distinguished from it, in being of uniformly smaller size,

more distinctly and remotely ribbed, and in being concentrically frilled throughout with a close succession of delicate laminæ.

TURBO MURREUS. *Turb. testâ minutâ, suborbiculari, vix umbilicatâ, lævigatâ, politâ, albâ, roseo nitidè maculatâ.*

Hab. — ?

A minute, delicately coloured, porcelain shell.

TURBO CORALLINUS. *Turb. testâ parvâ, suborbiculari-ovatâ, imperforatâ, conspicuè spiraliter sulcatâ; roseo-purpureâ, intùs margaritacè.*

Hab. — ?

Another interesting small species, of a dull livid rose-purple hue, strongly spirally grooved.

TURBO TROCHOIDES. *Turb. testâ subpyramidali-ovatâ, perforatâ; anfractibus spiraliter sulcatis, supernè concavis, deinde obsoletè nodosis; luteo-albicante, olivaceo radiatim maculatâ, lineolis minutissimis aurantio-fuscis, obliquè reticulatis.*

Hab. — ?

A species of peculiar sculpture and marking, partaking very much of the generic character of *Trochus*.

TURBO PUSTULATUS. *Turb. testâ ovatâ, subventricosâ, imperforatâ, nodis grandibus papillosis undique notatâ, aperturæ fauce argentatâ; albidd, olivaceo-fusco luteoque maculatâ.*

Hab. — ?

An interesting species covered with swollen nodules; collected by Sir Edward Belcher during the voyage of the 'Sulphur.'

TURBO TURCICUS. *Turb. testâ subpyramidali-ovatâ, imperforatâ, spiræ suturis excavatis, anfractibus spiraliter squamato-liratis, supernè declivibus, acutè angulatis, ad angulum erecto-squamatis, aperturâ parvâ, lutescente, coccineo rufo pulcherrimè radiatâ.*

Hab. Philippine Islands; Cuming.

A prettily painted species encircled by a diadem of erect scales.

TURBO PYROPUS. *Turb. testâ subdepresso-ovatâ, imperforatâ, spiræ suturis simplicibus, anfractibus lævibus, striisve spiraliter cingulatis; albidd, striis vividè rubris, intùs argentèâ.*

Hab. — ?

Of a deep blood-red colour, with the margins of the aperture united beyond the columella.

TURBO GEMMATUS. *Turb. testâ subdepresso-ovatâ, imperforatâ, spiræ suturis subprofundè canaliculatis, anfractibus nodulis parvis undique gemmatis; corallo-rufescente, intùs argentèâ.*

Hab. — ?

Very similar in form to the preceding species, and partaking in some measure of the colour; the spire differs in having the sutures deeply channeled, and the entire surface in being beaded with small papillose nodules. In the former species the margins of the aperture are entire, and it is the striæ that are coloured upon a white ground.

TURBO LUGUBRIS. *Turb. testâ suborbiculari-ovatâ, spirâ depressâ,*

anfractibus supernè declivibus, deinde nodulis papillois cingulatis, columellâ concavâ; albida, epidermide crassâ nigricante indutâ, columellâ et aperturâ argenteis.

Hab. — ?

Another species collected by Captain Belcher in the 'Sulphur,' not hitherto described.

TURBO NIVOSUS. *Turb. testâ oblongo-turbinatâ, imperforatâ, spirâ subæsertâ, anfractibus spiraliter liratis, liris obtusis, irregularibus, duabus prominentibus subsquamosis; vividè virescente, fusco hic illic maculatâ, liris prominentibus et inferioribus fusco niveoque articulatis, intûs argenteâ.*

Hab. Philippine Islands; Cuming.

A prettily painted species, apparently not described before.

TURBO TUMIDULUS. *Turb. testâ ovatâ, imperforatâ, spirâ subacuminatâ, anfractu ultimo amplo, tumidiusculo; anfractibus undique spiraliter liratis, liris angustis, confertis, valdè irregularibus, obliquè serratis; lutescente, intensè castaneo-nebulatâ.*

Hab. — ?

This species merges into the *T. spinosus*, but is very remotely connected with it.

TURBO CIRCULARIS. *Turb. testâ suborbiculari, imperforatâ, spirâ breviusculâ, anfractibus supernè depressis, liris obtusè nodiferis, alternatim majoribus, cingulatis; rosaceo-fusco alboque marmoratâ, columellâ plano-concavâ, albâ, intûs margaritaceâ.*

Hab. — ?

Very nearly allied in form and general aspect to the *T. Natalensis*, but readily distinguished on comparison.

TURBO PORCATUS. *Turb. testâ orbiculari, spirâ depressiusculâ, suturis excavatis, subtûs concavâ, profundè umbilicatâ, anfractibus fortiter spiraliter costatis, costis rotundatis, lirâ minutâ interveniente; viridi, rufo-olivaceo nitidè marmoratâ, intûs argenteâ.*

Hab. Point Swan, North Australia; Dring.

Allied in form to the *T. versicolor* and *porphyrites*, from both of which species it is sufficiently distinguished by its strongly-ribbed growth.

TURBO ARTICULATUS. *Turb. testâ ovatâ, vix umbilicatâ, spirâ acuminatâ, anfractibus subtubulosis, spiraliter obtusè costatis, costis irregularibus longitudinaliter creberrimè serrato-striatis; viridi purpureo-nigricante marmoratâ et variegatâ, intûs argenteâ.*

Hab. — ?

Allied to the *T. radiatus* in form, but peculiar in its articulated style of painting.

TURBO JAPONICUS. *Turb. testâ ovatâ, imperforatâ, tenuiculâ, subinflatâ, anfractibus lævibus, spiraliter costatis, costis nunc prominentibus, regularibus, nunc planiusculis, valdè irregularibus; spadiceo-luteâ, rufo variè tinctâ et maculatâ, intûs argenteâ.*

Hab. Japan.

Like most shells from the Japanese islands, this is of very peculiar

character, and very different from any of the tropical species of the genus.

TURBO MILITARIS. *Turb. testâ ovatâ, imperforatâ, tenuiculd, sub-ventricosâ, anfractibus lævibus, supernè declivibus; rufescente albâ, maculis lineisque rufis nitidè pictâ; columellâ margine livido-cinereo, intùs argenteo.*

Hab. Isle of Annaa (on the reefs); Cuming.

An interesting species of rather light growth, exhibiting a very distinct and characteristic style of painting.

TURBO HISTRIO. *Turb. testâ subglobosâ, tumidâ, imperforatâ, spiræ suturis excavato-canaliculatis, spiraliter liratis, liris subtilissimè laminiferis, squamatis, squamis fortibus, erectis; nived, aurantio-ferrugineo latè radiatâ, intùs argenteâ.*

Hab. —?

A shell of ventricose growth, strongly scaled, whilst the entire surface is very minutely laminated.

TURBO FLUCTUATUS. *Turb. testâ transversè ovatâ, crassiusculd, subventricosâ, imperforatâ; anfractibus lævibus, supernè rudè angulatis, ad angulum obsoletè nodosis, infrâ liris plano-obtusis, hic illic ferè evanidis cingulatis; columellâ concavâ; olivacè, lineis niveis viridi-umbratis, acutè undatis conspicuè longitudinaliter pictâ, intùs argenteâ; operculo testaceo, spiraliter sulcato, medio subtilissimè granuloso, marginem versus multiserrato.*

Hab. Punta, St. Elena, West Columbia; Cuming.

An extremely interesting species, which, though of rare occurrence, has long been known to me by the above name: from whom it received that appellation, which is very characteristic, I cannot, however, learn. It is a shell of solid growth, somewhat rudely noded, and obscurely flatly ridged. The ground-colour is that of a livid olive, very conspicuously marked with numerous zigzag lightning-like streaks of bright body-white, shaded with dark green.

The operculum is remarkable: testaceous and strongly spirally grooved, the innermost groove is broadly excavated, and the central mass is solid and minutely granulated, whilst the portion without the broad groove is arranged in numerous concentric, finely-serrated laminae.

April 11.—William Yarrell, Esq., Vice-President, in the Chair.

The following paper was read to the meeting:—

SUPPLEMENTARY NOTE ON THE GREAT CHIMPANZEE (TROGLODYTES GORILLA, *Savage*, TROGL. SAVAGEI, *Owen*). BY PROFESSOR OWEN, F.R.S. ETC.

Since the communication of my description of the skulls of the great Chimpanzee of the Gaboon district, I have received from an esteemed correspondent, Dr. Wyman, Professor of Anatomy in Harvard University, United States, and a most accomplished anatomist and physiologist, a copy of his description of the parts of the skeleton of the great Chimpanzee which Dr. Savage had taken with him on

his return to America, together with a preliminary and highly interesting sketch of the natural history of the species by its discoverer, who proposes to call it *Troglodytes Gorilla*, adopting the term used by Hanno in describing the wild men which he discovered on the coast of Africa during his famous voyage*.

Dr. Wyman gives dimensions of the skulls of a male and female *Troglodytes Gorilla*, with comparative measurements of a characteristic skull of a negro, and those of the *Troglodytes niger* and *Simia satyrus* (Sumatran variety, or *S. Abelii*) from my Memoir in Trans. Zool. Soc. vol. i. p. 374; and he sums up the following points as showing that from the *Troglodytes niger* the *Trogl. Gorilla* "is readily distinguished—

- " 1. By its greater size;
- " 2. By the size and form of the supraciliary ridges;
- " 3. By the existence of the large occipital and interparietal crests in the males, and by rudiments of the same in the females;
- " 4. By the great strength and arched form of the zygomatic arches;
- " 5. By the form of the anterior and posterior nasal orifices;
- " 6. By the structure of the infraorbital canal;
- " 7. By the existence of an emargination on the posterior part of the hard palate;
- " 8. The incisive alveoli do not project beyond the line of the rest of the face, as in the Chimpanzee and Orang;
- " 9. The distance between the nasal orifice and the edge of the incisive alveoli is less than in the Chimpanzee;
- " 10. The ossa nasi are more narrow and compressed superiorly."

The 5th, 7th and 9th are the characters which are most decisively repeated in the Bristol specimens of the skulls of *Trogl. Gorilla*, and are those that are least ascribable to age or the operation of external circumstances tending to produce a stronger variety of Chimpanzee. The value of the character from size is established by the concurrence of the foregoing more fixed ones. The supraciliary ridges are relatively as strongly developed and as prominent in the skull of a female adult *Trogl. niger* as in that of the *Trogl. Gorilla*, and they are as angular and rough or uneven in the skull of the adult male *Trogl. niger* as in that of the adult male *Trogl. Gorilla*. The male *Trogl. niger* shows also the median prominence between the orbits above the root of the nose.

In six skulls of *Troglodytes niger* Dr. Wyman found that "the temporal ridges are generally separated from each other by a space varying from half an inch to one or two inches, according to age, but in none of them is to be seen even a rudiment of the interparietal ridge." In an adult, but by the condition of the teeth, not old male *Trogl. niger*, the temporal ridges have met above the obliterated suture, and developed the rudiment of an 'interparietal ridge,' which would probably have risen above its rudimental state had the exercise of the large temporal muscles been longer continued.

* See the passage cited at p. 13, 'Falconer's Translation of the Voyage of Hanno,' London, 1797.

Processes, ridges and crests dependent upon the stimulus of muscular action for their development, are the seats of most variety, and the least safe or satisfactory osteological marks of specific distinction. In the great males of the *Tr. Gorilla* even a certain range of variety is presented by the skulls of the four adult males, which we are now able to compare.

In the one described by Dr. Wyman the interparietal or sagittal crest is elevated about $1\frac{1}{2}$ inch above the skull, and terminates above in a thin and free edge: in the fine male skull figured, and in the older male's skull, the two temporal ridges, though touching each other at their base, do not coalesce to form a single sagittal crest, but each terminates in a free edge, inclining from its fellow, and neither of them rise to half an inch at their highest part, three inches behind their point of contact.

4. The specific character of the zygomatic arches is best shown by the depth and convex or angular upper contour of the squamosal portion of the arch.

5. Dr. Wyman has well indicated the characteristic forms of the anterior and posterior nares; and the conformity of the four skulls, two males and two females, submitted to his able and scientific scrutiny, in this important character, with the three skulls which I have described, adds to our confidence in its constancy and value. The observed range of variety does not materially affect the well-marked difference of form in the posterior nares. Dr. Wyman finds in the *Tr. niger* that "the transverse diameter of the orifice exceeds that of the vertical, but in the *Tr. Gorilla* the vertical is twice that of the transverse, a condition which results from the elongation downwards of the superior maxillary bones." In one skull of an adult female *Trogl. niger*, in the Bristol Museum, the vertical diameter equals the transverse diameter of the posterior nares, and it exceeds it by about one-half only in the three skulls of the *Tr. Gorilla* in the same museum.

6. With regard to the sixth character, which was pointed out to Dr. Wyman by Prof. Agassiz, it is stated that "in the Chimpanzee the infraorbital canal forms a deep groove, terminating in the spheno-maxillary fissure, its depth remaining uniform to its termination; but in the Engé-ena (*Trogl. Gorilla*) the canal becomes gradually less deep from before backwards, and at the fissure is scarcely obvious." In the skull of the female *Trogl. Gorilla* (fig. 2) examined by me, the infraorbital canal is also shorter and shallower than in the skull of a female *Trogl. niger*, but the varieties observable in the condition of this canal in different individuals of the *Trogl. niger* are more marked than those above noticed in the skulls of the two species and induce me therefore to attach less importance to this character as a specific one. In two skulls of adult males, *e. g.* in the College of Surgeons, the infraorbital groove as it passes backwards again becomes a canal by the meeting, and in one specimen by the coalescence of the two sides of the groove above the canal for an extent of from two to three lines before it enters the spheno-maxillary fissure. Dr. Wyman indeed notices a similar conformation in an adult cranium of the Chimpanzee belonging to Dr. J. C. Warren. Now this is a

more decided difference from the continuous open groove at the floor of the orbit in the adult female *Tr. niger* than that groove presents in comparison with the shorter and shallower one in *Trogl. Gorilla*. I find too that the second character of *Trogl. Gorilla* pointed out by Prof. Agassiz,—“from the internal walls of the orbits which recede from each other in descending towards the floor, thus leaving a large pyramidal space for the lodgment of the os ethmoides,”—is so much less marked in the female skull of *Tr. Gorilla*, as contrasted with that of *Tr. niger*, as to induce me to view it more in the light of a sexual than a specific modification.

The seventh is a good character, and is repeated by each of the skulls of *Tr. Gorilla* examined by me. All the skulls of *Tr. niger* also show the backward projecting point, where the emargination exists in *Tr. Gorilla*.

8. The minor relative projection of the incisive alveoli beyond the line of the rest of the face is as characteristic of the three skulls of *Tr. Gorilla* now in England as of the four in the United States, and results from the same comparative shortness of the premaxillary bones, between the nasal orifice and the edge of the incisive alveoli. But the ossa nasi, besides being more narrow and compressed superiorly, are more prominent at that part in *Tr. Gorilla* than in *Tr. niger*, and they are also more expanded and broader inferiorly, and I cannot but regard the most decisive mark of the specific distinction of the *Troglodytes Gorilla* to be the longer persistence of the maxillo-premaxillary sutures, and the evidence thereby given of the peculiar form, development and connexions of the upper portions of the premaxillary bones. It is remarkable indeed, since these sutures remain so distinct in the adult female skull (fig. 2) and the younger adult male skull (fig. 1) here described, that no trace of them should have been detected in any of the four skulls taken by Dr. Savage to America, in which Dr. Wyman describes the ossa nasi as being “firmly co-ossified with each other and with the surrounding bones.”

The triangular expanded facial part of the upper end of each premaxillary intervening between the nasal and maxillary bones will always serve to distinguish the cranium of an immature *Trogl. Gorilla* from that of a *Trogl. niger*.

MISCELLANEOUS.

Note on the Development and Organization of Infusoria:—Gyratory Movements of the Vitellus: Pulsations of the Contractile Vesicle in the Egg. By M. F. POUCHET*.

I HAVE followed out the development of several animalcules: some emerge from the ovum with the form they are destined to present during the whole course of their existence (*Kerona*, *Vorticella*); others undergo, in the course of development, very apparent metamorphoses

* Communicated by J. T. Arlidge, A.B., M.B.

(*Kolpoda*, *Dileptus*). Owing to the latter circumstance, it has often happened that the young and the adult forms of the same animalcule have been described as distinct species. It is certain, for instance, that the *Glaucoma scintillans* (Ehr.) is but the foetal or imperfect condition of the *Kolpoda cucullus* (Müller).

In the ova of *Vorticellæ*, having a diameter of $\cdot 04$ of a millimetre, the vitellus clearly manifests gyratory movements, in all respects resembling those in the ova of mollusca and other animals. When the young *Vorticella* is fully developed and on the point of leaving the egg, this gyration is succeeded by movements of another description, viz. by contractions of the entire animalcule, which, as is observed, for example, in the young *Lymnææ*, seems to struggle under the transparent envelope of the egg.

In the ova of *Vorticellæ*, the animalcules of which are on the eve of exclusion, I have, in several instances, recognized the existence of the contractile vesicle, and have noted its movements. This vesicle was proportionately of less size than in the adult animal, and its pulsations were less frequent. These ova, at this period entirely occupied by the embryo animalcule, presented a diameter of $\cdot 04$ millimetre, and the contractile vesicle which was situated at about the centre, when of its greatest dimensions, $\cdot 005$ of a millimetre.

In the *Vorticellæ* there exists a sac, sometimes very evident, on the side opposite the cardiac or contractile vesicle, and extending nearly the whole length of the animal. The interior of this sac presents very distinct molecular movements, which seem clearly owing to the existence of vibratile cilia. At intervals this sac contracts from before backwards, and seems to transport in that direction a mass, distinct from the stomach vesicles which it compresses. This sac is the respiratory organ; and its movements have induced some observers to hazard the opinion of the formation of vacuoli in the substance of the animal, or to admit the existence of a form of circulation of granules, such as is noticed in vegetable cells.

From what proceeds, we must regard the contractile vesicle as a cardiac apparatus*. It is seen to manifest itself like the *punctum saliens* of oviparous embryos. And hence we cannot with Ehrenberg consider it as belonging to the genital, or, with Spallanzani, to the respiratory apparatus.—*Comptes Rendus*, Jan. 15th, 1849.

[If these researches of M. Pouchet be confirmed, an important step in advance has been made in our knowledge of the Infusoria. We can no longer doubt, with M. Dujardin, the existence of ova, and of oviparous reproduction in the true Infusoria or Polygastrica. But until this confirmation be given, such exceedingly delicate observations as those detailed must be received with some reserve; seeing that imagination, and the desire to indicate an analogy with the higher animals, are too apt to interfere with precise investigation in such minute beings.

Again, respecting the contractile vesicle said to be observable in

* Wiegmann (Archives, 1831) surmised the cardiac nature of this contractile vesicle; and Siebold entertains the same idea.—J.T.A.

the embryo *Vorticella*, it is stated that its pulsations were less rapid than in the full-formed animalcule; a circumstance at variance with analogy; for, in the embryos of higher animals, the contractions of the cardiac vesicle, or punctum saliens, are more frequent than those of the circulating sac in the adult. Moreover, if such a perfect system of organs, presenting a cardiac and a respiratory sac, be observable in the *Vorticella*, it must surely elevate that genus considerably in the scale of animals, and place it far above the majority of the polygastric Infusoria. And, consequently, if such a complex organism can be shown in the *Vorticellæ*, we are not to attribute a like one to those other Infusoria with which that family is at present associated; for the Monads, the Amœbæ, &c., are surely but one remove from homogeneous organic matter.—J. T. A.]

BRITISH MUSEUM, ZOOLOGICAL DEPARTMENT.—CONCHOLOGY.

It is suggested that the fields of the tablets on which shells are fastened should be stained with different colours corresponding to the following grand geographical divisions, which may be termed "generic:" 1. Europe; 2. Asia and its islands; 3. Africa; 4. Australia; 5. Polynesia; 6. North America; 7. South America.

Smaller specific geographical divisions might be indicated by a narrow border of a different colour to each tablet. When the locality may be unknown, the tablet may remain white until further information can be acquired. Such a plan would interfere in no wise with the arrangement of species according to their affinities, while it would facilitate the researches of the student, who could, at a glance, ascertain the country of a particular species, or direct his attention, in rapid succession, to all the denizens of the particular tract regarding which he is desirous of gaining information, merely by reference to an index-card showing the colours of the divisions and subdivisions. The specific subdivisions may be increased to any extent desirable by the use of double or treble borders of diverse colours.

The above is offered as an improvement on the system in use in some private entomological cabinets of distinguishing indigenous British species by a ticket of a conspicuous colour.—W. H. B.

February 24, 1849.

ENGLISH WILD BEASTS A CENTURY AND A HALF AGO.

"At Enfield, hardly out of the sight of smoke of the capital, was a region of five and twenty miles in circumference which contained only three houses and scarcely any inclosed fields. Deer as free as in an American forest wandered there by thousands. It is to be remarked, that wild animals of large size were then far more numerous than at present. The last wild boars, indeed, which had been preserved for the royal diversion, and had been allowed to ravage the cultivated land with their tusks, had been slaughtered by the exasperated rustics during the license of the civil war. The last wolf that has roamed our island had been slain in Scotland a short time before the close of the reign of Charles the Second. But many

breeds, now extinct or rare, both of quadrupeds and birds, were still common. The fox, whose life is, in many counties, held almost as sacred as that of a human being, was considered as a mere nuisance. Oliver St. John told the Long Parliament that Strafford was to be regarded, not as a stag or hare, to whom some law was to be given, but as a fox, who was to be snared by any means, and knocked on the head without pity. This illustration would be by no means a happy one if addressed to country gentlemen of our time: but in St. John's days there were not seldom great massacres of foxes to which the peasantry thronged with all the dogs that could be mustered: traps were set; nets were spread; no quarter was given; and to shoot a female with cub was considered as a feat which merited the gratitude of the neighbourhood. The red deer were then as common in Gloucestershire and Hampshire as they are now among the Grampian hills. On one occasion Queen Anne, on her way to Portsmouth, saw a herd of no less than 500. The wild bull with his white mane was still to be found wandering in a few of the southern forests. The badger made his dark and tortuous hole on the side of every hill where the copsewood grew thick. The wild cats were frequently heard by night wailing round the lodges of the rangers of Whittlebury and Needwood. The yellow-breasted martin was still pursued in Cranbourne Chase for his fur, reputed inferior only to that of the sable. Fen eagles, measuring more than 9 feet between the extremities of the wings, preyed on fish along the coast of Norfolk. On all the downs, from the British Channel to Yorkshire, huge bustards strayed in troops of fifty or sixty, and were often hunted with greyhounds. The marshes of Cambridgeshire and Lincolnshire were covered during some months of every year by immense clouds of cranes. Some of these races the progress of cultivation has extirpated. Of others the numbers are so much diminished that men crowd to gaze at a specimen as at a Bengal tiger or a Polar bear."—*From Macaulay's History of England.*

ON THALIELLA, A NEW GENUS OF CIRRIPEDES ALLIED TO SCALPELLUM.
BY J. E. GRAY, ESQ., F.R.S. ETC.

THALIELLA.

Valves 11; opercular valves subtriangular; dorsal elongate, curved; lower dorsal and anterior compressed, with two pairs of lateral valves in the middle of the body above the base. Peduncle with rings of imbricate horny scales.

This genus chiefly differs from *Scalpellum* in the front and hinder lateral pair of valves being each united into a single compressed valve, and in having no middle basal lateral valve.

This genus was shown to me by Mr. J. S. Bowerbank, who received it from Algoa Bay attached to some species of *Plumaria*.

THALIELLA ORNATA.

Pale horn-coloured, varied with red spots, or with a single red band on each side; valves horny, subpellucid, radiately striated.

On *Plumaria*, Algoa Bay, Cape of Good Hope. Presented to the British Museum by J. S. Bowerbank, Esq.

Stroem (*Nym. Saml. Danske*, 1788, 295, n. 111, f. 20) described a *Lepas testd compressa 7-valvis stipite lamellosa*, found on *Gorgonia placomus* in the North Sea, which is probably allied to this genus.—*From the Proceedings of the Zool. Soc. for March 14, 1848.*

POST-OFFICE REGULATIONS.

The speedy and cheap transmission of intelligence is of the highest importance for the interests of science. The want of it has been a subject of general complaint, and the editors of scientific journals can but too well appreciate the inconvenience, discouragement and loss which it occasions.

In the Advertisement prefixt to the eighth volume of the Monthly Notices of the Royal Astronomical Society, the Council regret the difficulty and delay in receiving scientific information. "With other countries," they observe, "and for larger parcels, the communication is most unsatisfactory. The expenses and extra charges at the English ports are equivalent to a negative upon direct intercourse, even where the freight is prepaid, and the duty trifling. The Post-office charges for pamphlets over-sea are the same as for letters. Until these matters are better regulated, a greater service can scarcely be rendered to scientific bodies than by facilitating the rapid transfer of international communications at a moderate cost."

Our friend Mr. Thompson of Belfast, in communicating to us the letter from Dr. Gould of Boston, U.S., has also directed the attention of our readers to the defective state of our means of communication, at p. 366 of our last volume; and we are glad to find that the hope which we there expressed has in some degree been realized, the subject having at length received attention from the authorities of the Post-office, by whom some important improvements have been introduced. With a view therefore to render these available, we subjoin the following particulars from the Post-office regulations of the most recent date.

Periodicals published as pamphlets, and parliamentary proceedings, provided they are made up in the same manner as newspapers, in covers open at the sides, so as to admit of examination, are forwarded to the countries mentioned below at the following rates, which must be prepaid either in stamps or money.

Weighting and	not exceeding	s.	d.	Weighting and	not exceeding	s.	d.
.....	2 ozs.	0	1	9 ozs.	10 ozs.	1	8
2 ozs.	3 *	0	6	10	11	1	10
3	4	0	8	11	12	2	0
4	5	0	10	12	13	2	2
5	6	1	0	13	14	2	4
6	7	1	2	14	15	2	6
7	8	1	4	15	16	2	8
8	9	1	6				

Beyond the weight of 16 ounces, they can only be forwarded at letter rates of postage.

* We cannot see the reasonableness of the scale in one particular; where the charge for 3 ozs. is six times as much as for 2 ozs.—*Ed.*

The countries to and from which the above rates are applicable are :

Belgium,	United States of America*,
Bremen,	
France,	Prussia {
Holland,	via Belgium†,
	via Holland,
	via Hamburg.

The rates to which parliamentary proceedings are liable when sent to the colonies, the rates for letters, prices current, &c., to the colonies and foreign parts in detail by every route, and numerous other particulars as to the despatch and arrivals of mails, &c. &c., will be found in the 'Post-Office Official Monthly Director,' corrected and published on the 1st of every month by Letts, Son and Steer, 8 Cornhill, price 1s. per single copy, or 8s. per annum.

THE TUI, OR PARSON-BIRD.

The 'Dido,' Capt. Maxwell, from Auckland, New Zealand, has brought home a few valuable curiosities for naturalists, the chief of which is a small black bird, about the size of the English blackbird, called the Tui (the parson-bird of Captain Cook), believed to be the first of the species ever brought to England alive. Many previous attempts have been made to bring this bird to England, but all hitherto have failed.—*From the Times.*

OBITUARY.—MR. EDWARD FORSTER.

We have to record the decease of our highly esteemed friend Edward Forster, Esq., F.R.S., the Treasurer and a Vice-President of the Linnæan Society, of which Society also he was one of the oldest Fellows. Mr. Forster died on Wednesday, February the 21st, after a severe attack of cholera of less than two days' continuance, having previously enjoyed his usual and equable good health up to his 84th year. His strong attachment to his favourite botanical pursuits, and his zeal for the prosperity of the Linnæan Society, of whose eminent founder Sir J. E. Smith he had been an intimate and warmly attached friend, require an ampler record than can now be given of one who in every relation of life was truly estimable :

Quem licet in sera rapuerunt fata senecta,
 Et vitæ saturnum sopiit alta quies,
 Nos tamen hunc, velut immaturo funere raptum,
 Flemus, et effusis diffluimus lacrymis.

Vixisti bene ac beate !

..... valente

Semper corpore, mente sana, amicis

Jucundus, pietate singulari.

* The regulations for forwarding periodicals to and from the United States are precisely the same as for the other countries mentioned, but in the case of pamphlets not being periodicals, to and from the United States, the weight is limited to 8 ozs.

† Periodicals, &c., when sent to Prussia *via* Belgium, are subject to a Belgian transit rate of 2*d.* per quarter ounce, in addition to the above rates. In charging works of this description, when more than one copy is under the same band, each copy is weighed and charged separately.

ROSSIA OWENII, BALL.

This fine Cuttle-fish, hitherto known only as an Irish species, has been lately taken by Mr. Saxby on the coast of the Isle of Wight.—
E. FORBES.

METEOROLOGICAL OBSERVATIONS FOR JAN. 1849.

Chiswick.—January 1. Overcast : hazy. 2. Clear and frosty. 3. Frosty : dry haze : overcast : frosty. 4. Uniformly densely overcast : rain. 5. Drizzly and foggy. 6. Overcast. 7. Overcast : rain at night. 8. Rain. 9. Very fine : slight rain. 10. Cloudy : boisterous : rain. 11. Rain : densely clouded. 12. Frosty : overcast : rain. 13. Densely clouded : rain. 14. Rain. 15. Clear. 16. Fine : rain. 17. Rain : densely overcast : clear. 18. Fine : boisterous at night. 19, 20. Very fine. 21. Very fine : overcast : boisterous. 22. Boisterous : fine : clear and boisterous. 23. Densely clouded : fine. 24. Cloudy : boisterous at night. 25. Densely clouded : boisterous. 26. Rain : exceedingly fine. 27. Slight frost : overcast : rain. 28. Cloudy : fine. 29. Rain : cloudy and cold : frosty at night. 30. Slight fog : drizzly. 31. Fine : clear and frosty at night.

Mean temperature of the month 39°·56
Mean temperature of Jan. 1848 33°·62
Mean temperature of Jan. for the last twenty years 36°·40
Average amount of rain in Jan. 1·59 inch.

Boston.—Jan. 1. Cloudy. 2—4. Fine. 5, 6. Cloudy. 7. Fine : rain early A.M. 8. Rain. 9. Fine : rain P.M. 10. Cloudy : stormy all day. 11. Cloudy : rain early A.M. 12. Fine. 13. Rain : rain early A.M. 14. Cloudy : rain early A.M. 15. Fine : rain A.M. and P.M. 16. Foggy. 17—20. Fine. 21. Cloudy. 22—24. Fine. 25. Cloudy. 26. Fine : rain early A.M. 27. Fine : rain P.M. 28. Fine. 29. Rain : rain A.M. 30. Cloudy : rain A.M. and P.M. 31. Fine.

Applegarth Manse, Dumfries-shire.—Jan. 1. Frost moderate. 2. Frost very hard : barometer falling. 3. Frost clear : fine. 4. Frost, but cloudy. 5. Frost : cloudy. 6. Frost : still cloudy. 7. Frost : still more overcast. 8. Thaw : rain : fog : rain again. 9. Frost again : clear A.M. : rain P.M. 10. Heavy rain during night : rivers flooded. 11. Frost A.M. : thaw at noon : rain. 12. Soft rain all day. 13. Soft rain : cleared : rain P.M. 14. Gentle frost : cloudy : wind rose. 15. Soft : cloudy. 16. Mild and clear after rain A.M. 17. Moist A.M. : rain and high wind P.M. 18. Very fine till noon : rained again. 19. Frost : getting cloudy P.M. 20. Heavy rain and high wind P.M. : thunder. 21. Storm of wind and rain. 22. Fair, but a storm of wind. 23. Fair A.M. : came on storm, wind and rain. 24. Rain nearly all day : wind high. 25. Fair and keen A.M. : wet P.M. : high wind. 26. Fair A.M. : rain P.M. 27. Snow : rain : wind high. 28. Frost : clear : dull P.M. 29. Frost and snow : thaw and rain. 30. Frost moderate. 31. Thaw and showery.

Mean temperature of the month 36°·35
Mean temperature of Jan. 1848 33°·80
Mean temperature of Jan. for the last twenty-five years . 34°·90
Rain 3·70 inches.
Rain in January 1848 2·34 „
Average amount of rain in Jan. for the last twenty years 2·60 „

Sandwick Manse, Orkney.—Jan. 1. Cloudy. 2. Bright : cloudy. 3. Cloudy. 4. Cloudy : frost : snow-showers. 5. Bright : cloudy. 6. Snow. 7. Thaw : clear. 8. Rain : showers. 9. Showers : cloudy. 10. Rain : snow. 11. Snow. 12. Rain : showers. 13. Showers. 14. Showers : sleet-showers. 15. Showers. 16. Showers : cloudy. 17, 18. Showers. 19. Showers : clear. 20. Cloudy. 21. Rain : showers. 22. Sleet-showers. 23. Sleet-showers : rain. 24. Rain* : sleet-showers : cloudy. 25. Sleet-showers : aurora. 26. Sleet-showers : cloudy. 27. Bright : sleet-showers. 28. Sleet-showers : clear. 29. Frost : cloudy. 30. Snow : sleet : showers. 31. Sleet-showers : showers.

* From 9 P.M. on 23rd till 2 P.M. on 24th (about 17 hours) 2·08 inches of rain fell.

Days of Month.	Barometer.				Thermometer.				Wind.				Rain.				
	Chiswick.		Boston. 8½ a.m.	Dumfries-shire.		Orkney, Sandwick.		Chiswick.		Boston. 8½ a.m.	Dumfries-shire.		Orkney, Sandwick.	Chiswick.	Boston.	Dumfries-shire.	Orkney, Sandwick.
	Max.	Min.		9 a.m.	9 p.m.	9½ a.m.	8½ p.m.	Max.	Min.		Max.	Min.					
1849. Jan.																	
1.	30.179	30.144	30.00	30.12	30.22	30.19	33	19	33	36½	31	37½	38½	e.	calm	e.	s.
2.	30.124	29.833	29.93	30.00	30.02	29.89	29	20	27	33	24½	34	39	e.	calm	e.	ws.w.
3.	29.744	29.696	29.59	29.70	29.83	29.89	32	23	27	29	15½	37½	36	e.	calm	e.	n.
4.	29.784	29.764	29.65	29.73	29.76	29.95	35	32	30	30	21	35	33	e.	calm	e.	nne.
5.	29.908	29.760	29.58	29.72	29.89	29.98	34	26	35½	35½	27½	34	35	ne.	calm	e.	w.
6.	30.011	29.995	29.79	29.93	29.85	29.92	35	19	33	30	21½	33½	31	ne.	calm	ne.	e.
7.	30.061	29.894	29.78	29.88	29.61	29.62	38	35	30	33½	25½	36	37	ne.	calm	nne.	se.
8.	29.589	29.553	29.38	29.35	29.25	29.24	42	34	37	39½	32	40	41	se.	sw.	ne.nw.	sse.
9.	29.591	29.483	29.15	29.31	29.14	29.17	47	37	38	42	33½	43	39	sw.	calm	e.	ese.
10.	29.133	29.002	28.64	28.48	28.86	29.14	49	38	45	44	35	37	33½	sw.	sw.	se.	e.
11.	29.417	29.055	29.86	29.31	29.65	29.74	40	24	38	41½	34	34	34	nw.	n.	nw.	s.
12.	30.136	29.879	29.85	29.75	29.37	29.31	38	36	32½	47½	27½	40	42	sw.	calm	sw.	w.
13.	29.736	29.586	29.30	29.40	29.24	29.12	53	49	43	44	39	41½	40½	sw.	s.	sw.	sw.
14.	29.859	29.474	28.83	29.00	28.94	29.24	56	32	54	43	40	41	43	sw.	sw.	w.	wnw.
15.	30.043	29.966	29.63	29.59	29.26	29.37	55	31	38	43	34½	44½	44	sw.	ws.w.	sw.	w.
16.	29.954	29.720	29.60	29.65	29.42	29.44	52	42	34	...	40	46	42	s.	sw.	s.	s.
17.	29.945	29.708	29.26	29.27	29.27	29.44	54	30	45½	...	...	41½	41½	sw.	ssw.	w.	ws.w.
18.	30.005	29.934	29.57	29.46	28.91	29.02	50	46	40½	...	...	48	45½	sw.	s.	w.	w.
19.	29.983	29.909	29.46	29.60	29.73	29.77	53	42	49	...	...	41½	37½	sw.	sw.	sw.	calm
20.	30.254	30.009	29.64	29.96	29.95	29.67	51	41	45½	...	...	41	40	s.	sw.	ne.	sse.
21.	30.238	29.965	29.60	29.69	29.37	29.07	50	39	46	...	...	38½	43	sw.	s.	sw.	sw.
22.	30.214	29.955	29.46	29.50	28.99	29.33	50	48	42	...	...	42	41½	sw.	ws.w.	w.	w.
23.	30.414	30.303	29.70	29.83	29.97	29.58	51	45	46	51	39	45	44	sw.	w.	ws.w.	w.
24.	30.374	30.200	29.80	29.82	29.70	29.49	50	47	47½	53	46	43½	41½	sw.	w.	ws.w.	w.
25.	30.089	29.907	29.52	29.56	29.14	28.99	51	44	50	50	47	43½	41½	sw.	ws.w.	w.	ws.w.
26.	29.931	29.804	29.32	29.39	29.16	29.55	49	26	41½	45½	36½	39	38	w.	ws.w.	w.	nw.
27.	29.948	29.385	29.05	29.67	29.29	29.50	45	34	34	40	31½	32	36	s.	ws.w.	se.	ese.
28.	29.379	29.321	28.94	29.10	29.30	29.47	45	33	39	39	33	39	34½	w.	sw.	sw.	nne.
29.	30.079	30.571	29.25	29.79	29.93	29.81	42	24	37½	37½	31½	34	36½	n.	nw.	ne.	s.
30.	30.138	29.805	29.77	29.68	29.63	29.37	48	29	33	48	30	37	38½	s.	calm	se.	w.
31.	30.242	30.131	29.74	29.88	30.03	30.01	47	22	35½	45	34½	41	39	w.	w.	w.	nnw.
Mean.	29.919	29.797	29.56	29.584	29.608	29.530	45.35	33.77	38.9	40.9	31.6	39.38	38.61	1.73	1.51	3.70	7.54

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SECOND SERIES.]

No. 16. APRIL 1849.

XXVI.—*Note on Cystocoleus, a new genus of minute Plants.* By
G. H. K. THWAITES, Lecturer on Botany and Vegetable Physiology in the Bristol Medical School.

[With a Plate.]

HAVING recently been fortunate enough to meet with good specimens of the *Byssus nigra*, Eng. Bot., I have been enabled to ascertain very satisfactorily its real structure, about which botanists appear hitherto to have been in much doubt. The structure of this plant is so peculiar as to render necessary its removal from the genus *Chroolepus*, in which it now stands; and with the sanction of my friend, the Rev. M. J. Berkeley, I propose for it the new generic name of *Cystocoleus*, characterized as follows.

Cystocoleus. Plantæ confervoidæ, cæspitosæ; filamentis articulatis, cylindricis vel submoniliformibus, plus minusve ramosis, vagina cellulosa continua singulatim inclusis. *Chroolepo* affinis.

Cystocoleus ebeneus. Fusco-niger, fragilis, parce ramosus. Conferva ebenea, *Dillw.* t. 101.

Byssus nigra, *E. B.* t. 702!

Chroolepus ebenea, *Ag. Syst. Alg.* p. 36; *Harvey in Eng. Fl.* p. 381; *Manual of British Algæ*, p. 190.

It will be seen by the above generic characters that this plant differs essentially from *Chroolepus* in having its filaments included in a sheath composed of distinct cells, the membrane of which is of a dark fuscous colour, and thus the internal filament can in most cases be with difficulty observed and examined. Occasionally, however, the internal filament, which in structure and character closely resembles the filaments of *Chroolepus*, protrudes beyond the investing sheath, and may then be seen to consist of oblong cells containing the peculiar reddish oily-looking endo-

chrome of *Chroolepus*. The investing sheath is similar in character to that of *Rhizonema interruptum*, Eng. Bot. Supp. t. 2954, but the cells composing the latter are not at all opaque. Delicate root-like appendages are given off from the sheaths of both species: indeed the analogy between these two species is curious, where the affinity is not very close.

It is interesting to observe in these minute plants a parallel and simultaneous growth of an internal filament and an investing sheath, each in some measure independent of the other and representing separate systems of cellular development. This will assist, I believe, to throw light upon the real structure of the apparently homogeneous gelatinous sheaths with which many of the lower plants are furnished.

Professor Harvey has placed provisionally in the genus *Chroolepus* some other minute species of a dark colour and having an external resemblance to the present plant: that excellent botanist, however, at the same time remarks that they will probably prove to be fungi. *Chroolepus*? *Arnottii*, Harv., for a specimen of which I am indebted to the kindness of Professor Harvey, is considered by Mr. Broome identical with the *Torula conglutinata* of Corda, and in this opinion I quite agree with him. It is properly an *Antennaria*. The present plant has nothing to do with the genus *Helminthosporium*, though some species of that genus has evidently been confounded with it by Capt. Carmichael and others.

Chroolepus and *Cystocoleus* form with the genus *Cænogonium*, Ehrenb., a small natural group, which it is difficult to locate in either of the principal divisions of cryptogamic plants. In the structure of their filaments they exhibit an affinity to the *Algæ*, whilst they resemble the *Lichens* in the kind of situations in which they are found growing. *Cænogonium* has, moreover, *apothecia* very like those of a Lichen. Professor Kützinger has grouped together the genera *Chroolepus*, *Chantransia* and *Chlorotylum*, constituting of them his family *Chantransiæ*, and arranging them amongst the *Algæ* near the *Draparnaldiæ*.

EXPLANATION OF PLATE VIII. B.

- Fig. 1.* Filament of *Cystocoleus ebeneus*, with root-like appendages. Magnified 270 linear.
- 2. Apex of a filament, in which the development of the investing sheath has been arrested, and exhibiting the internal filament like that of *Chroolepus*. Magnified 270 linear.
- 3. Portions of investing sheath. More highly magnified.

XXVII.—*Description of Coccochloris Brebissonii, a new species of the Palmelleæ, in conjugation.* By G. H. K. THWAITES.

[With a Plate.]

Coccochloris Brebissonii, n. sp. Frons saturate-viridis, gelatinosa, vix cartilaginea, effusa, nec frustulosa: cellulis subsphæricis vel rotundato-ellipticis, minutissime granulosis: sporangiis oblongis.

C. Brebissonii occurs upon the perpendicular surfaces of wet rocks, forming a gelatinous or slightly cartilaginous coating, separating very readily from the surface of the rock. It is of a pale green colour, sometimes slightly reddish. The cells are shortly elliptical with the ends much-rounded, and contain a minutely granulose endochrome of a yellowish green colour. The gelatinous appendages of the cells cohere to form an apparently homogeneous mass, and are not separately distinguishable as in some species of the genus. The cells when conjugating are at first united by a narrow connecting tube, but this soon enlarges to the width of the cells. The sporangium is of an oblong form and transparent, containing an endochrome somewhat similar to that of the cells, but with the granules much larger. Immediately that conjugation of two cells has commenced to take place, their granules of endochrome are observed to have increased in size, and this increase continues until the sporangium is mature. During the formation of the sporangium, the original cell-membranes appear to become absorbed, and are not thrown off as in *Cylindrocystis Brebissonii*.

Branched threads similar to those represented in my figure of *Palmella botryoides*, Grev.*, ramify throughout the gelatinous mass of the present species, but only in one instance have I succeeded in tracing a connexion between them and the cells, owing I suspect to the state of maturity of the plant. By watching the species attentively, I hope to be able to observe the early development of the plant from the contents of the sporangia.

This well-marked species, which is I believe undescribed, I have the greatest pleasure in dedicating to the learned French botanist M. de Brébisson, to whose researches we are indebted for the first discovery of species of *Palmelleæ* in a state of conjugation.

EXPLANATION OF PLATE VIII. C.

Fig. 1. Small portion of *Coccochloris Brebissonii*, showing the cells and ramifying threads.

— 2. Cells of *C. Brebissonii* in conjugation.

— 3. Mature sporangia. All magnified 270 linear.

* Ann. and Mag. Nat. Hist. Ser. 2. vol. ii. Pl. X.

XXVIII.—On some new Palæozoic Echinodermata.
By FREDERICK M'COY, M.G.S. & N.H.S.D. &c.

CRINOIDEA. (*Articulata*.)

Cupressocrinus (Gold.).

It will be observed in the following descriptions of two species of this genus hitherto only known in the foreign Devonian strata, that I have attributed interscapular plates to its cup as in *Poteriocrinus*, although such are not indicated in the figures or generic characters of Goldfuss. I have however detected them in an authentic specimen of his *C. crassus* from the Eifel in the Cambridge collection, although not so clearly as in the following species. In the number and position of the plates of the body, *Cupressocrinus* and *Poteriocrinus* are identical; and in both, the articulations for the arms extend the entire width of the upper edge of each of the scapulæ; but there is a striking difference in their form, which seems dependent on the total dissimilarity of their arms; the cup in the latter genus is elongate-conic, the comparatively narrow scapulæ giving off arms of moderate width, dichotomizing frequently, while in *Cupressocrinus* the cup is of an extremely wide saucer-like form, and the scapulæ of inordinate width to give origin to the curiously wide, massive, simple arms which render the genus so remarkable.

Cupressocrinus calyx (M'Coy).

Sp. Char. *Cup* very wide, evenly convex, saucer-shaped, three times wider than long; *pelvis* small, slightly concave, pentagonal, of five pentagonal pieces; alternating with and above which are five large first-costals, their length and width equal to the diameter of pelvis, four pentagonal and one with a very short sixth side; alternating with, and above those, are five pentagonal scapulæ, as long as the costals, but the width double the length; to the short side of the hexagonal costal is obliquely attached a long pentagonal intercostal supporting two very small interscapular plates; *scapulæ* very thick, articular surface flat with an articular ridge running its whole width; all the plates slightly convex and smooth. Width of cup 9 lines.

Rare in the carboniferous limestone of Derbyshire.
(Col. University of Cambridge.)

Cupressocrinus impressus (M'Coy).

Sp. Char. *Cup* four times wider than deep; *pelvis* concealed in a deep circular pit, out of which spring the broad ends of five ovato-lanceolate first-costals, the apex of one of which is trun-

cated to support a small elongate interscapular plate, and on its side rests a somewhat larger intercostal plate; *scapulæ* about one-third wider than long, pentagonal, the two lower sides concave, and the lower angles very much prolonged to fit between the lanceolate costals; substance of the joints very thick, projecting far into the visceral cavity, a strong perforated articular ridge runs across the top of the *scapulæ*; all the plates slightly convex and smooth.

Distinguished from the *C. calyx* by its deeply impressed pelvis and long, lanceolate first-costals.

Not very uncommon in the carboniferous limestone of Derbyshire.

(Col. University of Cambridge.)

(*Semiarticulata*.)

Poteriocrinus nuciformis (M'Coy).

Sp. Char. *Body* subovate, pointed below, constricted above from the upper margins of the *scapulæ* being narrower than their lower portion; *pelvic plates* very small, form unknown; first-costals long, pentagonal, very narrow below, giving a pointed appearance to the lower portion of cup; second costals large, tumid, subhexagonal, nearly twice the length of the first-costals, a little less wide than long; *scapulæ* pentagonal, about one-third wider below than above, giving a very perceptible, constricted appearance to the upper part of the cup, articulations apparently the whole width of the plate; irregular intercostal large, subhexagonal, supporting two small pentagonal interscapulars; surface smooth. Length of cup 8 lines, greatest diameter (at second costals) 7 lines.

This closely resembles the *P. Bockschii* figured by Geinitz in his 'Grundriss der Versteinerungskunde,' t. 23. f. 13, but of which no description or definition has been published.

Not uncommon in the carboniferous limestone of Derbyshire.

(Col. University of Cambridge—two examples.)

Poteriocrinus crassimanus (M'Coy).

Sp. Char. *Column* small, of thin circular joints; supracolumnar joint supporting five pentagonal first-costals, slightly wider than long, between and above which rest five pentagonal *scapulæ* about as long as the costals, but about one-third wider than long, each of which supports one large cuneiform *arm-joint*, wider than long, from each of which proceed two *hands* of six joints each, thicker on alternate sides, the last joint cuneiform and supporting two *fingers* of about thirty-five joints, each wider than long; costal and scapular plates ra-

diatingly marked at their margins. Length of cup $3\frac{1}{2}$ lines, width 6 lines, length of rays 2 inches.

Of the arms visible one has but four joints, one has seven, and the other three visible have six each. This species differs from the *P. radiatus* (Aust.) by the slighter radiation of the plates, the greater proportional width of the cup, the articulation of the arm-joint extending the full width of the scapulæ, the latter distinction being very striking as well as the consequent greater strength of the rays. The surface seems obscurely granulose, but is not distinctly preserved.

Rare in the carboniferous limestone of Hook Head, co. Wexford.

(Col. University of Cambridge.)

(*Inarticulata*.)

Platycrinus vesiculosus (M'Coy).

Sp. Char. *Body* spheroidal, depressed; visceral portion hemispherical, deeper than the cup; *pelvis* pentagonal, small, flattened; *scapulæ* small, rotundato-quadrata, one-third wider than long, very thick, gibbous, slightly concave in the centre, lower edge hanging below the pelvis, excavation for the first arm-joints very small, round, marginal, less than one-third the depth of the scapulæ; visceral plates very large, irregular, polygonal, some of them nearly equalling the scapulæ in size, they are moderately convex, and each rendered rugged by several small tubercular projections; mouth lateral, surrounded by small plates. Length of small specimen from pelvis to vertex 6 lines, width 8 lines.

The very large, bubble-like tuberculation of the visceral plates and the small, gibbous scapulæ give a most peculiar aspect to this species, quite unlike any other I am acquainted with. I find the characters very constant.

Not uncommon in the carboniferous limestone near Bakewell, Derbyshire.

(Col. University of Cambridge.)

Platycrinus diadema (M'Coy).

Sp. Char. *Body* very much depressed, spheroidal (from the base of pelvis to the vertex one-third less than the diameter between the arms); *pelvis* large, depressed, pentagonal, without divisional lines; columnar adherence circular, crenated, one-third the diameter of the pelvis, but seated in the bottom of a deep circular excavation three-fourths the diameter of the pelvis; *scapulæ* hexagonal, nearly twice as wide above as below, about one-third wider than long, very slightly convex except at the

articulation for the arms, which are prominent, very large, broad, and two-thirds the depth of the plate; interscapular plate large, hexagonal; visceral plates rather small, hemispherical. Height from pelvis to vertex 1 inch.

The very wide, depressed, turban-like form of this species (which I find constant) easily distinguishes it from its congeners. All the plates are even and smooth.

Not uncommon in the white decomposing encrinal beds of carboniferous limestone at Cleenish, co. Fermanagh, north of Ireland.

(Col. University of Cambridge and Royal Dublin Society.)

Platycrinus megastylus (M'Coy).

Sp. Char. Body broad ovate, visceral portion convex, not much elevated; *cup* rapidly expanding, conical; *pelvis* pentagonal, very small, resembling a prominent rim to the very large circular columnar attachment, the diameter of which is three times greater than from its circumference to the edge of the pelvic plate; *scapulæ* slightly convex, even, nearly twice as wide above as below, little wider than long; excavations for the arm-plates large, nearly half the depth of the scapulæ; capital plates variable in size and number, but large, few, unequal, polygonal, and most of them presenting a large conical protuberance in the centre; entire surface smooth. Length of body 10 lines, width between the arms 9 lines.

This species is excellently figured by Prof. Phillips (Geol. Yorksh.) with a doubtful reference to the *P. lævis* of Miller. The latter species is, I believe, generally admitted now to be distinct, but having examined specimens agreeing with the above figure, I find the species to which it belongs differs both from that to which Goldfuss and that to which Mr. Austin have referred it, by the comparatively enormous size of the columnar attachment, and the narrow prominent rim to which the rest of the pelvic plate seems reduced.

The specimens above described are from the carboniferous limestone of Bolland, where it occurs in company with numbers of the *P. pileatus*, Gold. (*P. antheliontes*, Aust.), which it much resembles, but from which it is easily distinguished by the above characters.

(Col. University of Cambridge.)

Actinocrinus (*Amphoracrinus* ?) *olla* (M'Coy).

Sp. Char. Inversely pyriform, very gibbous; *arm-bases* small, not very prominent; *cup* below the arms hemispherical, visceral portion above very wide, elevated, cylindrical; all the plates

above and below flattened; *pelvis* small, flattened, pentagonal, supporting on four of its sides four large hexagonal first-costal plates, about one-third wider than long, and on the fifth side one pentagonal plate; the five regular second costals are scarcely one-third wider than long, smaller than the first-costals and hexagonal, with the two upper lateral sides so short as sometimes to make the plates seem quadrangular; intercostals hexagonal, longer than the first-costals; pectoral plates rather large, flat, polygonal; *scapulae* pentagonal (or occasionally with the upper lateral angles truncated so as to be slightly heptagonal), one-third shorter than the first-costals; intercapulars heptagonal or octagonal, as long as the intercostals; the surface of all the plates marked with minute vermicular wrinkles. Diameter of cup 1 inch 9 lines.

The sculpturing resembles that of the *A. (Amphoracrinus) amphora*, from which the species is distinguished by its round inflated pot-like figure, small arm-bases, proportionate length of the costals, &c.

Very common in the Derbyshire carboniferous limestone in company with the *Poteriocrinus granulosus*.

(Col. University of Cambridge.)

Actinocrinus (Amphoracrinus) Atlas (M'Coy).

Sp. Char. General figure of *body* elongate-oval, diameter between the arms little more than half the height of the body; *pelvis* pentagonal, of three thick flattened joints; *first-costals* small, one pentagonal and five wider heptagonal, the latter nearly twice as wide as long; *second costals* as long as the first, but only one-third wider than long, hexagonal or sometimes quadrate (according as the upper lateral angles are entire or slightly truncated); *scapulae* short, pentagonal, as wide as the second costals; *intercostals* hexagonal, exceeding the first-costals in length; arm-bases prominent, and over each is an elongate conical tubercle; *pectoral plates* rather large, convex and irregularly polygonal; *vertex* covered by a very large hemispherical plate, surrounded by six slightly smaller polygonal ones having a large conical protuberance in the middle; *mouth* longitudinally oval, rather nearer the vertex than the arm-base over the pentagonal first-costal, to which it inclines; all the plates except the large ones of the vertex marked with minute vermicular wrinkles. Length from *pelvis* to plate on vertex $1\frac{1}{2}$ inch, diameter between the arms 10 lines.

The enormous size of the visceral portion above the arms (nearly three times the height of the cup) has suggested the specific name for this crinoid, which resembles the *A. (Amphoracrinus) Gilbertsoni* and *A. (Amphoracrinus) amphora* in its markings, pro-

minient tubercles over the arm-bases and great plates on the vertex; but it differs from those, besides the great size of the visceral portion, very obviously in the greater proportional length and less width of the costals, most remarkably of the second series.

Rare in the carboniferous limestone of Bolland.

(Col. University of Cambridge.)

Eucalyptrocrinus polydactylus (M'Coy).

Sp. Char. (Small concave *pelvis* not seen); *first-costals* hexagonal, convex, one-third wider than long, each supporting a quadrangular *second costal*, nearly twice as wide as long, its width nearly one-third less than that of the first costal; on each second costal rests a pentagonal *scapular* joint, equalling the second costal in width but exceeding it in depth; on each scapula rest two hexagonal *first arm-joints* nearly equalling the scapulæ in width and depth, and joining by their inner margins (so that the interbrachial plates cannot rest on the scapulæ); on each of these rests a smaller hexagonal *second arm-joint*, from each of which arise *two hands of four or five fingers each*; between the two second arm-joints of each arm is a small heptagonal *interbrachial* plate, its inferior pointed end resting on the two first arm-joints, and its truncated upper end supporting the small lozenge-shaped plate peculiar to this genus; circumscribed by the first and second costal, scapular, and first arm-plates, are the five large, equal, convex, nine-sided *intercostal* plates, each supporting on its upper edge a vertical row of three hexagonal interbrachial plates. Diameter of cup about $1\frac{1}{4}$ inch.

Besides the differences of proportion in the various plates which may be gathered from the description, this differs from the *Hypanthocrinus* (*Eucalyptrocrinus*) *decorus* (Phil.) and *E. rosaceus* (Gold.) in the lateral union of the first arm-joints, and their supporting the interbrachial plates, instead of the scapulæ, the scapulæ consequently being pointed above; also in the plates resting on the intercostal not being bifid, and most remarkably from all of the genus in the number of fingers, there being but two to each hand in the other species.

Rare in the Wenlock limestone of Dudley.

(Col. A cast in the University collection at Cambridge.)

BLASTOIDEA.

Pentremites campanulatus (M'Coy).

Sp. Char. Bell-shaped, base as wide as the body; pseudambulacra* wide above, tapering to the angles at the base; trans-

* I use the word pseudambulacra here to designate those poriferous rows in *Pentremites*, &c. which resemble ambulacra, but the pores of which are

verse suture between the first and second series of supra-basal plates nearly medial; base flattened; surface minutely granulated. Length 3 lines, width 3 lines.

If we suppose the lower third abruptly cut off a *P. ellipticus*, we should have a good idea of this little species, which agreeing with the above in most characters is distinguished by its small size, more tapering ambulacra, greater proportional width and wide base.

Rare in the carboniferous limestone of Derbyshire.

(Col. University of Cambridge.)

Codaster (M'Coy), n. g.

Etym. κώδων, *tintinnabulum*, and ἀστὴρ, *stella*.

Gen. Char. Cup conical, with the upper part broad, flat, truncate; *pelvis* deep, conical, of three pieces, one tetragonal and two pentagonal, each having its inner apex notched to form part of the round columnar canal; on the upper edges of these rest five large equal first supra-basal plates which reach to the truncated summit, to which from their mesial gibbosity they give a pentagonal outline; in the centre of this superior disc the mouth seems situated, and from it five prominent, minutely porous pseudambulacra diverge, one to each angle, each being placed on a thick tapering ridge divided by a mesial sulcus; from the re-entering angles of those ridges four other thick, rapidly tapering ridges proceed, one to the middle of each of four of the straight sides, each ridge at its thick, oral end shows an obscure impression, probably of the ovarian pores; the fifth space is without a ridge, being occupied by a large, ovate or lozenge-shaped (? anal) opening; the depressed, triangular intervening spaces are marked with coarse, rough parallel striæ nearly coinciding in direction with the pseudambulacral ridges, and converging to the second set of ridges; the impressed lines between these striæ seem punctured, the fifth (? posterior) space is without sulcation.



Flat terminal disc
of *Codaster*.

These strange and beautiful forms, the 'bell-stars,' as they may be called, are obviously allied to *Pentremites* (taking *P. Derbiensis*, *florealis*, *oblongus*, *ellipticus*, and such like as the types of the genus), from which they differ in having the small basal plates enormously developed into a conical pelvis, and having the pseudambulacra entirely confined to the capital plates (which here

found by MM. Roemer and Yondell (Bulletin de la Soc. Géol. de France for 17th April 1848) to be really the alimentary canals of a double row of little jointed tentacles resembling I imagine those of *Pseudocrinites*.

form a truncated disc) instead of being continued through a slit in the supra-basal plates nearly to their base. On the nature of the peculiar sulcation, represented in the subjoined sketch in four of the interambulacral spaces, I have no remark to offer. In Prof. Forbes's paper on the British *Cystidea* in the second volume of the 'Memoirs of the Geol. Survey,' p. 529, there is a figure representing "the projection of the arm-bearing surface of the *Pentremites pentagonalis*," which resembles the disc of our genus except in having the posterior interambulacral space sulcated, and with a thick mesial ridge like the rest; I do not suppose that that figure is meant to represent the *Platycrinus pentagonalis* of Miller, forming the *Pentremites id.* of G. Sowerby and Phillips, which presents no resemblance of the kind. I only know the following two species, from the carboniferous limestone.

Codaster acutus (M'Coy).

Sp. Char. Pelvic and supra-basal plates of equal length; pelvis acutely conical, obtusely subtrigonal in section; columnar adherence small, round, prominent; surface smooth. Length 6 lines, width of disc 5 lines.

Not very uncommon in the carboniferous limestone of Bolland. (Col. University of Cambridge.)

Codaster trilobatus (M'Coy).

Sp. Char. Supra-basal one-third longer than the basal or pelvic plates; pelvis divided into three tumid lobes which hang below the columnar adherence; surface smooth. Length 7 lines, width of disc 5 lines.

Not uncommon in the carboniferous limestone of Derbyshire. (Col. University of Cambridge.)

Ord. PERISCHOECHINIDA (M'Coy).

All the known Echinida—from the spheroidal *Echini* with the mouth and anus both central, one vertically under the other, to the elongated, symmetrical *Spatangi* with their mouth and anus at opposite ends of the ventral disc—all agree in having their case made up of twenty vertical rows of plates, ten ambulacral and ten interambulacral. This is not only the most persistent character of the entire group, but the number becomes of extreme interest when, with Agassiz and Valentin, we view the globose test of the sea-urchins as a mere modification of the same parts which we find in a 5-rayed starfish,—an ideal division of the mesial suture connecting the two rows of plates in each interambulacrum of the former, giving at once the ambulacra, lateral ossicles, and other characters of the latter. The Echinites of the palæozoic rocks however are constructed on an entirely different plan, having *three*

or more rows of interambulacral plates, instead of two as in those of the newer rocks and existing seas; as therefore those sea-urchins differ from all of the order Echinida in the great number of rows of plates in the test, usually having an odd number of rows in the interambulacra, and the consequent impossibility of theoretically dividing them at the sutures into five equal parts, I would propose to form a peculiar order for their reception under the above title, indicating the complexity of their structure. I first drew attention to the structural peculiarities of those fossils in 1844 in my 'Synopsis of the Carb. Limest. Fossils of Ireland' (p. 171 to 174), where I gave the generic characters of the genus *Palæchinus* (proposed in manuscript by my friend Dr. Scouler), and described and figured several species having from three to five rows of plates in the interambulacra. In the same work I stated that the plates of the so-called Cidarites of the carboniferous period being hexagonal was a proof that they too must have had, like the *Palæchini*, more than two rows of interambulacral plates, and being consequently distinct from the newer fossil and recent *Cidaris*, I mentioned that I had long distinguished them in manuscripts (in the collections at Dublin) under the name of *Archæocidaris*. In that work I withdrew my own name however in favour of *Echinocrinus*, by which M. Agassiz had announced his intention of designating the carboniferous *Cidaris Nerii*, &c. in his Introduction to the 2nd livr. of his 'Monog. des Echinod. Fossiles,' p. 15: although he did not either define the genus or recognise the aforesaid peculiarities, the name itself seemed to indicate an entirely different affinity, namely with the Crinoidea, in which group this generic name is placed in Agassiz's 'Nomenclator Zoologicus.' I propose to resume now my old name for this genus, 1st, because M. Agassiz neither indicated the affinities nor gave any descriptive notice of the genus *Echinocrinus*, while I have done both for my *Archæocidaris*; 2nd, several of the continental geologists have not followed my example in rejecting my own name, but prefer *Archæocidaris*; 3rd, in the 'Catalogue Raisonné des Echinodermes,' &c., published by MM. Agassiz and Desor in the 'Annales des Sc. Nat.' for November 1846, no mention is made of the genus *Echinocrinus*, but the species which were to have formed the type of it (*Cidaris Nerii*, &c.) are given under the new title of *Palæocidaris*, which of course has no claims for adoption on the score of priority; nor do MM. Agassiz and Desor even there seem aware of the peculiarity in form of the interambulacral plates or their abnormal number, although my observations on those points are mentioned by M. Verneuil nearly two years before in his 'Coup d'œil général sur la Faune Paléozoïque de Russie,' prefixed to the second vol. of MM. Murchison, Verneuil, and Keyserling's great work on

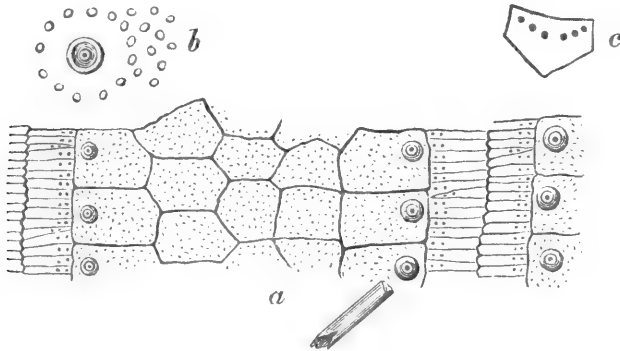
Russia and the Ural Mountains. Under those circumstances, therefore, it seems the most simple and correct course to use the term *Archæocidaris* for those fossils.

The order *Perischoechinida* may be divided into two families : 1st, *Palæchinidæ*, having the interambulacral plates crowded with small, subequal, spinigerous tubercles, not perforated, the spines of one form (including *Palæchinus*, *Melonites*, Owen and Norwood, &c.); 2nd, *Archæocidaridæ*, having the spines and tubercles of two forms and sizes, the primary spines very large, generally muricated, crenulated at the base, and each supported on a large mammillated and perforated primary tubercle surrounded by an elevated ring, never more than one on any plate, generally surrounded by a crowd of the small secondary tubercles (including *Archæocidaris*, M'Coy, and the following). These family divisions rest on the same characters as the separation of the true *Echini* and the *Cidaridæ* among the normally formed *Echinida*.

Perischodomus (M'Coy), n. g.

Etym. περισχών, *complexus*, and δῶμα, *domus*.

Gen. Char. Spheroidal, depressed, subpentagonal; ambulacra narrow, of two rows of small plates, most usually of a trans-



- a.* Diagram of portion of interambulacrum and ambulacra of *Perischodomus*.
- b.* One of the primary and some of the secondary tubercles magnified more highly.
- c.* One of the ovarian plates.

versely elongate pentagonal figure, and each pierced by one pair of simple pores; interambulacra wide, of five rows of plates very irregular in size and shape, all the plates covered with small equal granules or secondary tubercles, while the row on each side adjoining the ambulacra alone bear the small, smooth primary spines, one on each, the supporting tubercle being small, mammillated, perforated, but not crenulated, surrounded by a double ring and situated not in the centre, but near the ambulacral edge, a little above the middle; ovarian

plates pierced each with six foramina; mouth and anus small, both central.

This genus is remarkable for the irregularity of form and size of the interambulacral plates, differing in this both from *Archæocidaris* and *Palæchinus*; from the former it also differs in the greater number of the interambulacral plates being destitute of the mammillated primary tubercle, and by its small size and lateral position on those plates which do bear it; from *Palæchinus* it differs, besides the above, in the two rows of primary tubercles to each interambulacrum, &c. I at present know but one species.

Perischodomus biserialis (M'Coy).

Sp. Char. Diameter (of flattened specimens) about $2\frac{1}{2}$ inches, width of ambulacra at middle 3 lines; width of mouth and ovarian circle each about 3 lines; granules on the five rows of irregular interambulacral plates scarcely visible, the two rows of mammillated and perforated primary tubercles bordering the ambulacra very small; two rows of ambulacral plates, about six or seven occupying the same space as one of the interambulacral plates of the middle of the row.

Some few of the ambulacral plates are wedge-shaped, pointed towards the interambulacra, as in the sketch. The primary spines, as far as seen, were cylindrical and smooth.

Rare in the lower carboniferous limestone of Hook Head, Wexford.

(*Col.* University of Cambridge (anal and genital half), and Dr. Griffith at Dublin (oral half).)

XXIX.—*Algæ Orientales*:—*Descriptions of new Species belonging to the genus Sargassum.* By R. K. GREVILLE, LL.D. &c.*

[Continued from p. 219.]

[With a Plate.]

16. *Sargassum squarrosum* (nob.); caule filiformi, angulato; foliis (parvis) anguste obovatis, obtusis, plus minusve repando-dentatis; vesiculis subsphæricis, brevissime petiolatis; receptaculis obovatis vel lineari-oblongis, plano-compressis, acute lateque dentatis.

Hab. in mari Peninsulæ Indiæ Orientalis; Wight.

Root I have not seen. *Stem* filiform, angular, a foot to, probably, a foot and a half long, bushy with numerous branches which appear to be generally 2 or 3 inches long. *Leaves* small, half an inch or, rarely, three-fourths of an inch in length,

* Read before the Botanical Society of Edinburgh, February 8, 1849.

narrow-obovate, rounded at the apex, attenuated at the base into a slender and rather long footstalk, often nearly entire, but more generally repando- or even serrato-dentate, furnished with pores, and a nerve which disappears before reaching the summit. *Vesicles* nearly the size of hempseed, subspherical, supported on stalks scarcely a line long. *Receptacles* a line or more in length, axillary, obovate, or oblong, compressed, the margin and apex furnished with broad sharp teeth; frequently the receptacles are proliferous, the whole forming a very irregularly divided raceme, which is sometimes so twisted and curled as to give it the appearance of a cluster of minute proliferous leaves.

From the two imperfect specimens which I possess of this plant, I suspect that it is subject to considerable variation, and my figure and description are given chiefly with a view of affording algologists a memorandum for its more accurate investigation. On one of my specimens several of the leaves are converted into vesicles, which are supported on stalks 2 lines long resembling the lower part of the leaf; these are also winged and apiculate.

17. *Sargassum divaricatum* (nob.); caule angulato; foliis linearibus, acuminatis, breviter petiolatis, uninerviis, subintegerrimis; vesiculis numerosis, sphaericis, petiolatis, petiolis planis, dilatatis; receptaculis cylindraceis, filiformibus, divaricato-dichotomis.

Wight in herb. no. 7.

Hab. in mari Peninsulæ Indiæ Orientalis; Wight.

Root I have not seen. Entire plant probably a foot or more in length. *Stem* nearly as thick as a crow-quill, giving off spreading branches at short intervals 4 to 6 inches long, which are clothed with numerous short ramuli and leaves, so as to give the whole plant a bushy appearance. *Leaves* somewhat more than an inch in length, a line or more broad, more or less acuminate, entire, or rarely obscurely subdentate, shortly petiolate, furnished with a nerve and pores. *Vesicles* spherical, smaller than hempseed, on little flat dilated petioles about a line long; sometimes they are margined, and occasionally on longer stalks resembling an abbreviated leaf, and apiculate. *Receptacles* filiform, cylindraceous, subdichotomously divided, the segments spreading, the whole forming axillary tufts, often 3 or 4 lines in length. *Colour* reddish brown, that of the receptacles black. *Substance* cartilaginous.

A well-marked species, the receptacles separating it at once from its congeners. When luxuriant the three or four tufts on a ramulus seem to form one mass, and to the naked eye suggest the idea of a little parasitic *Gigartina*, and is by no means unlike dwarf specimens of *Gymnogongrus Griffithsiæ*, Mart. Sometimes the receptacles are less abundant and conspicuous, having fewer

divisions, the segments however being often nearly 2 lines long. The leaves bear a considerable resemblance to those of *Sargassum bacciferum*, but are much more numerous.

18. *Sargassum acutifolium* (nob.); caule plano-compresso, distiche ramoso; foliis linearibus utrinque attenuatis, acutissimis, integerimis, uninerviis, ad ramulos filiformibus; vesiculis sparsis, subellipticis, petiolatis, petiolis planis; receptaculis compressis, lineari-oblongis, ad apicem dentatis.

Sargassum acinaria, Ag. Sp. Alg. vol. i. p. 22??

Hab. in mari Peninsulæ Indiæ Orientalis; Wight.

Root I have not seen. Plant probably 2 or 3 feet long. *Stem* (or probably primary branch) plano-compressed, a line or more broad, distichously branched; branches about an inch apart, 8–12 inches long, flat like the stem, bearing ramuli 2–3 inches long, at intervals of $\frac{1}{2}$ to $\frac{1}{3}$ of an inch, which in their turn bear a smaller series upon which the fructification is placed. *Leaves*, the larger ones at the base of the branches, 2 inches in length, linear, acuminate at each extremity, entire, furnished with a nerve and a few scattered pores: the rest much smaller, almost filiform, those accompanying the fructification sometimes so slender as to be capillary. *Vesicles* scarcely half the size of hemp-seed, very sparingly developed, somewhat elliptical, on flat slender stalks, 2 lines or more long, mostly produced at the base of the racemes of receptacles. Sometimes a vesicle occurs at the extremity of a leaf. *Receptacles* minute, axillary, oblong or linear-oblong, compressed, generally toothed at the apex, forming more or less divided racemes. *Colour* reddish black. *Substance* cartilaginous.

It is not without considerable hesitation that I separate this plant from *Sargassum acinaria* of Agardh. There are however differences, judging from his description, (and in the absence of authenticated specimens,) which seem to be sufficiently decisive. The stem in *S. acinaria* is said to be angular. In the specimens before me both it and the branches are clearly plano-compressed, and give off the ramifications in a distichous manner. This character alone would remove my plant from the species above mentioned. The receptacles, described simply as cylindraceous in *S. acinaria*, are in the present plant, when fully developed, more or less compressed, and toothed at the apex. The cauline leaves are not "lanceolate," being too narrow to be termed even linear-lanceolate; but this is a character so liable to variation that much stress cannot be laid upon it. The racemes of fructification are truly axillary. The vesicles (in the specimens under examination) very few. *Sargassum acutifolium* is, from the abundance of the narrow leaves (which spread at a considerable angle), and also of the closely approximated tufts of

receptacles, very bushy in appearance. My specimens are not more than 14 inches long, but evidently indicate a plant 2 or 3 feet in length.

EXPLANATION OF PLATE X.

Sargassum squarrosum.

Fig. 1. A branch.

— 2. Leaves.

— 3. Vesicles.

— 4. Receptacles.

The last magnified.

Sargassum divaricatum.

Fig. 1. One of the ramuli.

— 2. Vesicles.

— 3. Do.

— 4. Receptacles.

3 & 4 magnified.

Sargassum acutifolium.

Fig. 1. A small branch.

— 2. Do. from a young plant.

— 3. Vesicles.

— 4. Do. produced at the end of leaves.

— 5. A raceme.

— 6. A single receptacle.

5 & 6 magnified.

XXX.—*Descriptions of two new Birds from Jamaica.*

By PHILIP HENRY GOSSE.

THE former of the two species which I am about to describe was accidentally overlooked in writing my 'Birds of Jamaica,' and the latter has been discovered since the publication of that work.

Elania cotta. Length $5\frac{1}{2}$ inches, expanse of wing $8\frac{6}{10}$, flexure $2\frac{6}{10}$, rictus $\frac{1}{2}\frac{5}{10}$, tarsus $\frac{8}{10}$, middle toe $\frac{6}{10}$. Irides dark hazel; feet dark slate-gray; beak black. Head blackish ash; crown brilliant yellow, commonly concealed; back and rump olive; tail blackish with olive edges; wing black; the primaries edged faintly, the secondaries, tertiaries and greater coverts conspicuously, with pale yellow; third quill longest. A white stripe, ill-defined, over the eye, meeting on the forehead; ear-coverts white, with dark tips; chin, cheeks, throat, and breast white, speckled obscurely with black beneath the eyes; belly, vent, under tail-coverts, and inner surface of wings, delicate pale yellow.

This little Tyrant, for want of any obvious peculiarities to distinguish it from others of its genus, I have named from the locality where I first met with it, the Cotta-wood, a tangled cop-pice on Grand Vale Mountain, in the parish of St. Elizabeth. I afterwards observed it in other situations, as in the woods around Bluefields, but it does not appear to be anywhere common: nor am I able to say whether it is a permanent resident, or merely a

winter visitant in Jamaica. Its manners, as far as I have noticed them, resemble those of the other Tyrants; pursuing insects in the air, and retiring to a prominent twig to eat them. I have observed one attack with much clamour a John-to-whit (*Vireosylva olivacea*), on the wing.

A figure of this species will be found in my 'Illustrations of the Birds of Jamaica,' Part xiii. plate 45.

Trochilus Maria. Length $4\frac{1}{10}$ inches; wing from flexure $2\frac{4}{10}$; rictus rather more than $\frac{7}{10}$; tarsus $\frac{2}{10}$; middle toe $\frac{3}{10}$. Beak (in a dried state) blackish brown above, buff below, with the tip black: irides — ?; feet black. Crown dull black, each feather tipped with a spangle of green and bronze, the spangles having a tendency to form longitudinal rows: nape and sides of the neck blackish, beset with spangles less numerous, but larger and more golden than on the crown: back and shoulders of wings richly bronzed with a ruddy golden hue, slightly tending to green in some lights; rump and upper tail-coverts more decidedly golden green; tail black, glossed with golden green, principally towards the tips of the feathers, the uropygials having more of the metallic lustre than the rest; wing quills and greater coverts purplish black, the innermost coverts and the winglet tipped with golden: throat, breast and belly emerald green, not scaly, the tips of the feathers only being metallic and showing the brownish black bases between them: vent and under tail-coverts black. The specimen appears to be an immature male.

This specimen of a species previously unknown to me was obligingly forwarded to me by my esteemed scientific friend, Richard Hill, Esq. of Spanish-Town, to whom it was sent from the mountains of Manchester. It is near to *Polytmus*, but differs from it in the inferior length of its beak, and in the colours of the plumage; but being apparently young, it is impossible to say what its adult condition may prove. I am happy however to fortify my own judgment by that of Mr. Gould, who on my showing it to him decidedly pronounced it new.

Mr. Hill writes me concerning the specimen: "It was startled from a nest in which were two young ones, and was obtained by charging some of the blossoms of the mountain-pride (*Spathelia simplex*) on which it was feeding, with minute doses of strychnine. As soon as it sucked from one of the poisoned chalices, it fluttered, and fell dead."—"The nest does not differ in structure from those made of the drab-coloured down of the *Eriodendron*, or of the *Ochroma lagopus*, with a stucco of lichens."

Mr. Hill had at first proposed to name this species "*bracteatus*," but afterwards substituted the feminine appellation, which I have pleasure in placing at the head of this article. "Doubting," he observes, "whether *bracteatus* was sufficiently

distinctive, I had meditated calling it *Maria*, in remembrance of my late talented little niece, who had assisted me so much in my natural history studies, by collecting specimens and getting up facts relating to the instincts and habits of the objects I noted or described. *Maria* was with me in Manchester when I procured the green-backed swallow (your *Hirundo euchrysea*), and we visited together in the very district where this new *Trochilus* was found; but I hesitated about the adoption of her name, from the impossibility of putting it in any other way than as '*Trochilus Maria*,' though *T. Cora* and *T. Mango* might reconcile me to it. [Other examples, as *Anna*, *Sappho*, &c., might also be added.] I leave the matter in your hands, but would suggest that the specific soubriquet should be considered undetermined, till fresh specimens be obtained."

A figure of this specimen appears in my 'Illustrations,' Part xiii. plate 22.

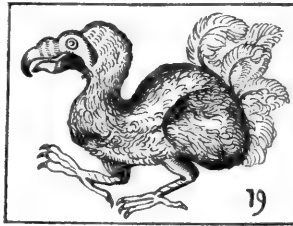
XXXI.—*Supplementary Notices regarding the Dodo and its Kindred.* Nos. 4, 5. By H. E. STRICKLAND, M.A., F.G.S.

[Continued from p. 139.]

4. *The Dodo applied to Heraldry.*—I am indebted to the Rev. Richard Hooper, of St. Stephen's, Westminster, for obligingly calling my attention to what may be called the heraldic department of the Dodo-history. The introduction of such a subject into a scientific journal would require apology were it not certain that many a curious fact of history, both physical and civil, may be disentangled from the quaint devices of armorial pageantry. It now appears that besides the "human Dodos" referred to by a witty (yet scientific) writer in *Blackwood's Magazine* (Jan. 1849, p. 81), a family has existed in modern times, bearing the synonymous name of Dronte, and decorated with a Dodo on their armorial shield. Could we now trace out the whereabouts of this family, we might possibly elicit from their archives some original facts connected with the present matter. All my inquiries about the Dronte family have indeed hitherto been fruitless, but I hope that this notice may induce heraldic students to throw light on the subject. The passage to which I here refer is contained in the '*Academy of Armory and Blazon*' by Randle Holme, published at Chester in 1688; book ii. ch. 13. p. 289. The Rev. J. Baron of Queen's College, Oxford, has kindly afforded access to a copy of this rare work in the library of that college, and has enabled Mr. Delamotte to engrave the following facsimile of the heraldic device. This figure seems to have been copied, with a little alteration, from that contained in the rare edition of Bon-

tekoe (see 'Dodo and its Kindred,' p. 63), but the description is evidently taken from Clusius, *Exotica*, cap. iv. The author judiciously points out the discrepancy between the colour of the wings as given by Clusius and Bontius, which is explained by Dr. Hamel ('Der Dodo,' &c. pp. 25, 34) to have arisen from a mistranslation of the original Dutch of Van Neck.

It is remarkable that although Holme takes his description from the works of Clusius and Bontius, yet his figure is copied from neither, but is taken from a third, and wholly independent, source. This seems conclusive as to the actual existence of a family bearing these arms; for had they been Holme's own invention, he would naturally have copied the figure from one of the two works which furnished him with the description. So now to our author.



"He beareth Sable a *Dodo*, or *Dronte* proper. By the name of *Dronte*. This exotic bird doth equal a *Swan* in bigness, and is of some authors termed *Gallus Peregrinus* and *Sygnus Cucullatus*, a *Hooded Swan*; yet it is of a far different shape. For the head is great, covered (as it were) with a certain membrane, resembling a hood. The bill is thick, and long, yellow next the head, the point black; the upper chap is hooked at the end, the lower chap had a blew spot between the yellow and black. It is covered with thin short feathers, and wants wings; in stead thereof it hath four or five long black feathers; that the hinder part of the body is round, flat, and fleshy, wherein for the tail were four or five small curled feathers, twirled up together, of an ash colour. The legs thick and short with long sharp pointed toes, yellowish; claws black. Thighs covered with black feathers, the rest of the body grey. Yet *Bontius*, lib. 5. chap. 17. in his *History of India*, describes it to have a great ill-favoured head, covered with a membrane like a hood; the bill bluish white, the tips of the upper mandible black, the lower yellow, the body is covered with soft grey feathers; the soft feathered wings of a yellowish ash colour; legs yellowish, and both them and the toes set with broad scales."

5. *Stones in the stomach of birds, indicative of frugivorous habits.*—In the 'Dodo and its Kindred,' p. 43, it is stated that

“stones are only swallowed by frugivorous birds, which require them to triturate their food, and are never found in the gizzards of the Raptores.” Hence it was argued, that the Dodo, which is known to have had stones in its stomach, could have no affinity to Raptorial birds. Dr. G. Dickie of Aberdeen has however called my attention to a passage in Sir J. C. Ross’s Antarctic Expedition, which shows that the above generalization, though undoubtedly true in general, admits, like all rules, of an exception. It is there mentioned (vol. ii. p. 159) that stones were usually found in the stomachs of the *Aptenodytes Forsteri*, to the amount of two to twenty lbs. weight. This is certainly a remarkable fact in the case of a piscivorous bird, and indicates some peculiarity in its habits which it would be desirable to clear up. Do any of the fucivorous Fish swallow pebbles to help digestion, and can the Penguin have thus acquired these foreign matters at second hand? But whatever be the cause of this habit in the Penguin, it does not affect the argument as to the remoteness of the Dodo from the Raptorial birds.

XXXII.—*Contributions to the Botany of South America.*

By JOHN MIERS, Esq., F.R.S., F.L.S.

[Continued from p. 146.]

BRACHISTUS.

A PARTICULAR group of plants has been before alluded to under this name (*ante*, p. 144), most of which have been referred to *Witheringia* by Prof. Kunth, and from which genus I have shown that they differ by having a campanular calyx generally with an almost entire margin, which does not enlarge with the fruit, by a much smaller berry and other characters. They are also distinct from *Acnistus* by the calyx being generally entire on the margin, rarely 5-toothed, and not having the five strong prominent nervures which give to the calyx of the latter genus the appearance of an almost pentangular tube: they differ also in the much shorter tube of the corolla, a more rotate border, more dilated stamens arising from a triangular expansion at the base, as in *Hebecladus* and *Saracha*; their flowers are considerably less in size, and they have smaller berries, which exhibit a very thin membranaceous dissepiment, not thickened in the middle by the confluence of the placentæ, as in *Witheringia*, *Acnistus*, *Iochroma*, *Saracha*, &c.; the placentæ on the contrary, originating from a central line in the middle of the dissepiment, are thin and slender, projecting for a short distance at right angles into the cavity of the cell, and then become furcated, continuing mem-

branaceous, with numerous seeds attached on each side. The ovarium is also surrounded at its base by a distinct annular disc, and is not seated simply upon a fleshy torus as in *Acnistus*. These plants appear to me closely allied to the *Physalis arborescens*, Willd, which, on account of its arborescent habit and its different form of flower, I propose to separate from that genus and attach to this group. They may thus be made to constitute a distinct genus under the name of *Brachistus*, from *βράχιστος*, *brevissimus*, on account of the shortness of the tube of their corolla. As *Iochroma* (which I have made to include *Chanesthes*) differs from *Acnistus* principally in the length of the tube of its corolla, so *Brachistus* on the other hand is not less distinct from that genus on account of the extreme shortness of the tube of the corolla, and its deeply cleft rotate border. This genus will first include all the species of *Witheringia* of Prof. Kunth (of which I will give below amended characters) with the exception of *W. riparia*, which from its infundibuliform corolla is evidently an *Acnistus*, and *W. angustifolia*, which from its racemose blue flowers and other characters evidently does not belong to this genus, appertaining more probably to the same group as *Solanum montanum*. For the same reason are excluded the *W. crassifolia*, Dun., and *W. pendula*, R. and Sch. The *W. salicifolia*, Hook., is a *Capraria* according to Mr. Bentham, although it offers regular pentandrous flowers: it evidently belongs to the genus *Xuaresia* of R. and P.: the six herbaceous species of *Witheringia* of Dunal and Sprengel enumerated by Dr. Walpers (Repert. iii. pp. 31, 32), as I have before remarked, appear to me to belong to *Solanum*. The following I consider to be its generic characters:

BRACHISTUS (gen. nov.).—*Calyx* parvus, urceolatus, margine integro, vel rarius 4–5-dentato, persistens et non augescens. *Corolla* subrotata, tubo brevi, limbo 4–5-partito, lobis oblongis acutis, æstivatione valvata. *Stamina* 4–5, erecta; *filamenta* imo subdilatata, paulo supra basin corollæ adnata; *antheræ* oblongæ, submucronulatæ, 2-lobæ, lobis arcuatis adnatis margine exteriore dehiscentibus. *Ovarium* ovatum, disco annulari imo cinctum, 2-loculare, dissepimento tenui utrinque in placentam membranaceam bifidam ovuligeram producto, ovulis plurimis. *Stylus* simplex, longitudine staminum. *Stigma* clavatum, sub-2-lobum. *Bacca* parva, globosa, calyce parvulo suffulta, 2-locularis. *Semina* compressa, in pulpo aquoso nidulantia, sublenticularia, *testa* aspero-scröbiculata; cætera ignota.—Arbores vel frutices *Americæ Æquinoctialis*: folia alterna vel sæpius gemina, altero multo minori et heteromorpho, subintegra vel angulato-dentata; flores axillares, fasciculato-congesti, perpauci, vel rarius solitarii, pedicellis 1-floris, gracilibus, erectis, demum cernuïs.

1. *Brachistus stramonifolius*. *Witheringia stramonifolia*, *H. B. K. Nov. Gen.* iii. 13;—arboreus, ramulis angulatis, pubescentibus; foliis ovatis, acuminatis, inæqualiter cordatis et dentato-angulatis, hirtellis, geminis, altero dimidio brevioribus; floribus fasciculato-congestis, hirtellis, pedunculis nutantibus, 5-meris, staminibus margine pilosis, inclusis; bacca pisiformi, calycis persistentis duplo diametro.—Mexico.

The leaves are said to be 4–5 inches long, 2–3 inches broad, on a petiole 1–1½ inch: the flowers (fifteen to twenty) are aggregated in each extra-axillary fascicle, the peduncles varying from 6 to 20 lines in length; the corolla, the size of that of *Capsicum frutescens*, has an expanded 5-partite border, the mouth of the short tube being pilose, the filaments are hairy on the margins. The berries are red, globular, 3 lines in diameter, and are supported by their small persistent calyx on slender deflexed peduncles.

2. *Brachistus macrophyllus*. *Witheringia macrophylla*, *H. B. K. loc. cit.* 14;—fruticosus, ramulis subangulatis, tenuissime puberulis; foliis ovato-ellipticis, subacuminatis, subrepandis, glabriusculis, superioribus geminis, altero minore; floribus plurimis, fasciculato-congestis, petiolo dimidio brevioribus, 4-meris, glabris, pedunculis filiformibus cernuis; corollæ tubo brevi, limbo 4-partito, patente, filamentis margine villosis; bacca minima, calyce parvulo suffulta.—Nova Granada.

The leaves are stated to be 8 inches long and about 4 inches broad, somewhat smooth, but slightly woolly on the primary nervures, and supported on a petiole 14–15 lines long, which is slender, caniculate and pubescent. The flowers are numerous in each fascicle upon slender, smooth peduncles 4–5 lines long. The calyx is small, almost entire or obsoletely 4-toothed, and quite smooth. The corolla, not larger than that of *Solanum nigrum*, is of a greenish hue, with a very short tube, a rotate border with four pointed lobes, the included filaments being very short, flattened and ciliate on the margins; the anther lobes are adnate, lanceolate, pointed, erect, and bursting on the margins. The ovary is small, rounded, smooth, and seated on a glandular disc. The berry is red, not larger than a peppercorn, and supported upon its small calyx.

3. *Brachistus ciliatus*. *Witheringia ciliata*, *H. B. K. loc. cit.* 15.—fruticosus, ramis teretibus, glabris; foliis oblongis, acutis, basi angustatis, integerrimis, ciliatis, geminis, altero duplo minore; floribus 5-meris, parvis, paucis (1–2), extra-axillaribus, pedunculis capillaceis pubescentibus; calyce urceolato obsoletè dentato, dentibus linearibus pubescente; corolla glabra, tubo brevi, limbo angulato sub-5-lobo patente, lobis acutis; bacca

globosa, calyce parvulo suffulta.—Nova Granada, in *Andibus excelsis*.

This plant bears very much the appearance of *Solanum philly-reoides*, Dun. The leaves are smooth, thin and membranaceous, ciliate on the margins, $1\frac{1}{2}$ inch or more in length, 7 lines broad, on a pubescent petiole 4–5 lines long. The flowers, solitary or binate, are about the size of those of the last species, the very slender peduncles measuring 8–9 lines: the pubescent calyx is almost entire on the margin, with five nearly obsolete erect teeth, the filaments are short, quite smooth and dilated below, the anthers oblong, obtuse, erect, bursting on the margins.

4. *Brachistus mollis*. *Witheringia mollis*, *H. B. K. loc. cit.* 15.—fruticosus, ramulis teretibus, cano-tomentosis; foliis ovatis utrinque acuminatis, integerrimis, supra pubescentibus, subtus molliter cano-tomentosis, geminis, altero multo minore et difformi; floribus 5-meris, extra-axillaribus (2–3–4), pedunculis filiformibus, elongatis, cernuis; corollæ tubo brevi, limbo angulato sub-5-lobo, laciniis acutis, staminibus glabris inclusis; bacca minima, calyce parvulo suffulta.—Caxamarca, Peruviae.

The leaves of this species are from $1\frac{1}{2}$ to 2 inches long, and 9 to 12 lines broad, on a tomentose petiole 3 lines long. The peduncles, from 9 to 11 lines in length, are slender, hairy, dependent, but erect in fruit; the flowers are the size of those of the two former species; the calyx is urceolate, incano-tomentose, with five short linear teeth; the corolla is hairy outside, has a plicate and a somewhat pentangular limb with acute angles; the stamens, five or six, are short, smooth and erect; the berry, not larger than a peppercorn, is supported on its very small persistent calyx.

5. *Brachistus rhomboideus*. *Witheringia rhomboidea*, *H. B. K. loc. cit.* 15.—fruticosus, ramis teretibus, tomentosis; foliis ovatis, acutiusculis, basi rotundatis et inæqualibus, integerrimis, supra molliter pubescentibus, subtus cano-tomentosis, geminis, altero minore; floribus paucis (4–6), extra-axillaribus, fasciculatis, pedunculis filiformibus petiolo longioribus; corolla rotata, limbo 5-fido, laciniis acutis, apice hirtellis.—Nova Granada (Quindiu).

The branches of this species are said to be somewhat scandent; the leaves are scarcely 1 inch long, $\frac{3}{4}$ inch broad, upon cano-tomentose petioles 2 to 5 lines in length: the peduncles are 4 or 5 lines long, cernuous in flower, erect and 7 to 8 lines long in fruit. The flowers are the size of those of the three foregoing species; the calyx, cano-tomentose, is urceolate, with a nearly entire margin, and five short linear distant teeth: the corolla is

glabrous, with a rotate 5-fid border, the segments being oblong, acute and hairy at the apex ; the filaments are subulate, short and smooth.

6. *Brachistus dumetorum*. *Witheringia dumetorum*, *H. B. K. loc. cit.* 16.—fruticosus, ramulis subangulatis, junioribus tomentosis ; foliis ovatis, subacuminatis, basi cuneatis, supra hirtopilosis, subtus hirtotomentosis et canescentibus, superioribus geminis, altero minore ; floribus geminis aut ternis, extra-axillaribus, pedunculis filiformibus, tomentosis, petiolo multo longioribus ; corolla rotata, limbo 5-fido, laciniis brevibus, acutis, apice hirtis ; staminibus inclusis, glabris.—Nova Granada.

The leaves have a somewhat obtusely pointed acuminate apex, and are gradually contracted at base upon a short and caniculate tomentose petiole of 2 lines in length ; they are from 12 to 16 lines long and 6 to 8 lines broad, somewhat coriaceous, with parallel nervures, which with the midrib are prominent beneath. The peduncles are 3 to 5 lines long, filiform and tomentose ; the flowers are the size of those of the preceding species, the calyx of which it also resembles in form ; the corolla is rotate, smooth and plicated ; the filaments are very short, subulate and smooth.

7. *Brachistus riparius*. *Witheringia riparia*, *H. B. K. loc. cit.* 16.—fruticosus, ramulis angulatis, hispido-pilosis ; foliis suboblique obovato-oblongis, acuminatis, basi acutis, supra glabris et læte viridibus, subtus in rachin pilosis, geminis, altero multo minore ; floribus plurimis, fasciculatis, congestis, extra-axillaribus, petiolum subæquantibus ; corollæ tubo calyce duplo longiore, infundibuliformi, limbo 5-partito ; bacca sphærica.—Nova Granada (*Andibus Quindiuensibus*, alt. 6300 ped.).

This species, from the greater length of its corolla, might be referred to *Acnistus*, did not the habit of the plant show it to be congeneric with the above-mentioned species described by Prof. Kunth. The larger of the geminate leaves are from 8 to 10 inches long, $2\frac{1}{2}$ to $3\frac{1}{2}$ inches broad, upon petioles 5 to 8 lines long, caniculate and hispid ; the smaller leaves in each pair are only $1\frac{1}{2}$ to 3 inches long, upon a much shorter petiole, and they are elliptic or ovate-elliptic, and acute at both ends. The flowers are fasciculated upon distinct peduncles, and are about the size of those of *Lycium barbarum*. The calyx is urceolate, obsoletely 5-toothed, thin and smooth ; the corolla is of a greenish white colour, smooth, the border divided into five equal divisions ; the filaments are pilose at base, the anthers oblong, bursting longitudinally ; the style is smooth and longer than the stamens.

8. *Brachistus hebephyllus* (n. sp.) ;—fruticosus, ramulis teretibus, elliptico-lanceolatis, attenuato-acuminatis, basi subcuneatis, integris, utrinque molliter incano-pubescentibus ; floribus plurimis, parvulis, 4-meris, axillaribus, fasciculatis, pedunculis filiformibus, petiolo subæqualibus, pilosis ; calyce piloso, urceolato, margine integro, ciliato ; corolla rotata, laciniis 4, oblongis, acutis, margine ciliatis, tubo brevi, intus pilosulo, staminibus brevibus, erectis : ovario ovato, disco annulari insito : stylo staminibus superante, subincurvo ; stigmatе clavato ; bacca parva, calyce minimo suffulta.—Nova Granada, v. s. in herb. Hook. (Los Tapios, Quindiu, Goudot, sub nomine "*Witheringia mollis*, H. B. K.")

This species, although approaching the *Witheringia mollis*, H. B. K., is certainly distinct from it in the form and size of its leaves, and its much smaller flowers, which are 4-merous : it has also an entire calyx. The leaves are 3 to $3\frac{3}{4}$ inches long, and about 1 or $1\frac{1}{4}$ inch broad, upon a petiole from 5 to 9 lines in length ; the flowers, from 6 to 10 or more, are crowded in each axil, the pedicels being 5 lines in flower and 7 lines in fruit, they are pubescent and erect ; the corolla has a short tube with a 4-fid expanded border ; the filaments are gradually dilated to the base, smooth and somewhat pilose at the point of their insertion in the middle of the short tube, which is there pubescent ; the anthers are ovate, cordate, acute, adnate, and terminated by a sharp point ; the style is long, slender and exserted, somewhat incurved, with a small clavate stigma ; the ovarium is ovate, and surrounded at the base by an annular fleshy ring ; the berry is about the size of a peppercorn, supported on its smaller persistent withered calyx ; the dissepiment and bifurcate placentæ are membranaceous : the seeds were too immature to determine the form of the embryo*.

9. *Brachistus oblongifolius* (n. sp.) ;—fruticosus, ramulis teneris, teretibus, glabris ; foliis oblongis, utrinque acuminatis, omnino glabris, breviter petiolatis, inferioribus subcoriaceis, rugoso-venosis, superioribus planiusculis, submembranaceis, geminis, altero tertio vel quarto minore, rhomboideo-ovato, breviter petiolatis ; floribus pentameris paucis, fasciculatis (2–4) ; pedunculis subcernuis, petiolo æquilongis ; calyce urceolato, brevissime 5-dentato, glabro ; corolla tubulosa, breviter infundibuliformi, limbo 5-lobo expanso, laciniis acutis, staminibus vix inclusis, filamentis filiformibus, medio tubi insertis, tubo hinc pubescente, aliter intus glabro.—Nova Granada, v. s. in herb. Hook. (Pantano del Moral, Ibagué, Goudot.)

* A figure of this species with generic details will be given in Plate 36 of the 'Illustr. South Amer. Plants.'

The larger leaves are 5 inches long and 2 inches broad, on a petiole of 4 lines ; the smaller leaves measure $2\frac{1}{2}$ inches long and $1\frac{1}{2}$ inch broad, on a petiole of 3 lines ; the peduncles are from 4 to 6 lines long ; the calyx urceolate, 1 line long ; the tube of the corolla 3 lines, its segments 2 lines long*.

10. *Brachistus dimorphus* (n. sp.) ;—fruticosus, ramulis teretibus, glaberrimis ; foliis elongato-lanceolatis, apice acuminatissimis, basi oblique in petiolum attenuatis, adultis utrinque glabris, supra ad rachin scabrido-pilosis, margine subciliatis, junioribus sparse pilosis, geminis, difformibus, altero multo minori, rotundato-ovato, sessili, basi inæquali, supra glabro, subtus pallide fulvescente ; floribus pentameris binis, extra-axillaribus, cernuis, petiolo brevioribus ; calyce urceolato, fere integro, pubescente ; corollæ tubo brevissimo, limbo 5-partito, expanso, lobis acutis ; filamentis subulatis, compressis, glabris ; antheris oblongis ; stylo exserto, subincurvo ; stigmate clavato, sub-2-lobo.—Nova Granada, v. s. in herb. Hook. (Los Tapios, Quindiu, Goudot.)

This species is very distinct, its larger leaves being so extremely different in form from the others ; they are $3\frac{1}{2}$ – $3\frac{3}{4}$ inches long, $\frac{3}{4}$ inch wide, on a petiole barely $\frac{1}{2}$ inch in length, the smaller geminate leaf being 10 lines long and 7 lines broad ; the peduncle is scarcely 2 lines, and the corolla 2 lines in length ; the calyx is 1 line long and in diameter, submembranaceous, without nervures, and with five obsolete teeth on its almost entire margin†.

11. *Brachistus? lanceæfolius* (n. sp.) ;—ramis ferrugineo-tomentosis, dichotomis, ramulis angulatis, divaricatim flexuosis, vix ligneis ; foliis alternis, lanceolatis, utrinque acuminatis, integris, supra parce, subtus densius fulvo-puberulis, petiolo subbrevis ; floribus e dichotomiis solitariis, vel e turionibus fasciculatis ; pedunculis 1–4, unifloris, pilosis, apice incrassato-incurvis ; calyce piloso brevi, urceolato, angulato, margine fere integro, dentibus 5 minimis instructo ; corolla rotata, subglabra, limbo 5-lobo, lobis acutis, triangularibus, reflexis, margine floccosis ; staminibus inclusis, erectis, glabris ; stylo apice incrassato, stigmate capitato-bilobo.—America æquinoctialis, v. s. in herb. Hook. (Loxa, regno Quitensi, Seemann, p. 879.)—(Vita, Peruvæ, McLean.)

This is a plant very distinct from the others, with very dichotomously spreading branches, which have a more medullary and less ligneous substance : there is no indication of fruit in the spe-

* This species is represented in Plate 37 A. of the ‘Illustr. South Amer. Plants.’

† A drawing of this species is shown in Plate 37 B. of the ‘Illustr. South Amer. Plants.’

cimens referred to, but the structure of the flower corresponds with that of all the plants above described. The leaves are $2\frac{3}{4}$ – $3\frac{1}{2}$ inches long, 1 – $1\frac{1}{2}$ inch broad, upon a petiole 4–6 lines in length; the peduncle measures $\frac{5}{4}$ inch, the calyx 3 lines in diameter; the corolla, including the acuminate segments, is $\frac{3}{4}$ inch diameter.

12. *Brachistus Hookerianus* (n. sp.);—fruticulosus, ramulis striatis, molliter pilosis, demum glabris; foliis ovatis, utrinque abrupte acuminatis, imo in petiolum longe decurrentibus, utrinque sparse molliter hirsutis, demum subglabris, margine ciliatis, rachi incrassato venisque pinnatis glabris, geminis, altero multo minore; floribus pentameris, parvulis, axillaribus, fasciculato-congestis; calyce minimo, pubescente, margine integro, dentibus 5, setaceis; corolla lutea, glabra, tubo brevi, subcampanulato, limbo rotato, 5-angulato, angulis acutis, pilosulis; staminibus brevibus, glabris.—Ecuador, v. s. in herb. Hook. (Cerro de Lantana, Guayaquil, Jameson, et in horto Kewensi cultus.)

This pretty species is remarkable for the abundance and brilliancy of its small yellow flowers. Its leaves are $2\frac{3}{4}$ inches long, $1\frac{1}{2}$ inch broad, with a somewhat winged petiole $\frac{3}{4}$ inch long; the peduncle measures 7 lines, the calyx 1 line, with remote setaceous teeth $\frac{1}{2}$ a line in length; the corolla is 5 lines in diameter.

13. *Brachistus diversifolius*. *Witheringia diversifolia*, Klotsch MSS.; Walp. Rep. iii. 29;—suffruticosus, ramis teretibus, subglabris, ramulis pubescentibus; foliis ovatis, acutis, basi abrupte attenuatis, utrinque sparsim pubescentibus, plerumque geminis, altero obtusissimo duplo minori; pedunculis axillaribus, solitariis, calyce 5-dentato, corolla lutea, 5-fida.—Mexico.

This plant was cultivated in the Botanic Garden of Berlin, from whence the particulars of the above description are probably derived.

14. *Brachistus Neesianus*. *Physalis arborescens*, Linn. Sp. Pl. 261; Nees ab Esenb. Linn. vi. p. 456;—suffruticosus, ramulis angulatis, tomentosis; foliis alternis, superioribus geminis, ovato-oblongis, acumine obtusiusculo, attenuatis, inæqualiter repando-dentatis, crassiusculis, supra subtiliter, subtus densius tomentosis, pilis canis, stellatis; floribus paucis (2–3), extra-axillaribus, pendulis; calyce urceolato, pubescente, 5-fido, dentibus ovatis, obtusiusculis, canescentibus; corolla rotata, ultra medium 5-fida, laciniis lanceolatis, extus tomentellis; fructu ignoto.—Mexico (Yucatan).

This plant has always been referred to *Physalis*, but doubtfully by Nees, who hardly considered it to belong to that genus, on

account of its manifestly fruticose habit, and the different structure of its flowers: with *Brachistus* it appears to correspond sufficiently, although nothing is yet known of its fruit. Willdenow considers this plant the same as that figured in Miller's Dict. tab. 206. Tab. 20*, but Nees holds a contrary opinion (Linn. *loc. cit.* p. 441), principally on account of its leaves being opposite; it is however most likely that its geminate leaves may have been mistaken by Miller as opposite.

The leaves are said to be 2 inches long, 1 inch broad, on a petiole $\frac{1}{2}$ – $\frac{3}{4}$ inch in length; the peduncles are 2–2 $\frac{1}{2}$ lines long, the calyx scarcely 2 $\frac{1}{2}$ lines; the corolla, including the lobes, is 3 $\frac{3}{4}$ lines in length.

15. *Brachistus* ? *Linnaeanus*. *Physalis arborescens*, Linn. *Sp. Pl.* 161; *Spr. Syst. Veg.* i. 696;—caule arborescente; foliis ovatis, subangulatis, subtus lanatis; floribus solitariis.—Mexico.

This species is excluded by Nees (Linn. vi. 483) from *Physalis*, and considered by him as altogether distinct from the foregoing. From the above short character it is impossible to come to any decided opinion on the subject.

XXXIII.—*The Musci and Hepaticæ of the Pyrenees.*

By RICHARD SPRUCE.

[Continued from p. 106.]

THE abbreviations made use of in this Catalogue are (besides those above-mentioned for the zones of altitude) *P. occ.*, *P. c.* and *P. or.* for *Pyrenæi occidentales*, *centrales* and *orientales*, respectively; *M. P.* for “*Musci Pyrenaici* quos in Pyrenæis centralibus occidentalibusque, necnon in Agro Syrtico, A.D. 1845–46 decerpsit Richard Spruce. Londini: 1847;” and *H. P.* for a similar fasciculus of the *Hepaticæ* of the Pyrenees, and of the same date.

I have made a point of citing the original description of each species, and one good figure of it, where such exists: the few synonyms that are occasionally given have been in most cases ascertained from authentic specimens.

As to those localities which I owe to the observations of my friends, I have affixed an autopsial mark (!) to the finder's name in all cases where I have had the opportunity of examining his specimens; and where I have not only done this but have also observed the same species in the very same place, a similar mark

* “*Physalis foliis ovato-lanceolatis, integerrimis, oppositis, caule fruticoso.*”

of verification is attached also to the locality: see, for an example, the stations mentioned for *Hypnum Starkii*.

Ordo MUSCI.

Hemicyclum 1. *Pleurocarpi*.

Tribus 1. HYPNACEÆ.

1. *Hypnum*, Dill., Linn.

Obs. A large proportion of the species of this genus inhabit the *Zona montosa superior* and the *Zona subalpina*, in some instances exclusively. In Z_3 they become much more rare, and above the line where forests disappear, *Hypna* can barely be said to exist. Of the rupestral species, the following were observed only on *calcareous* rocks or soil: *H. abietinum*, *recognitum*, *striatulum*, *murale*, *crassinervium*, *Vaucheri*, *Teesdalii*, *tenellum*, *rugosum*, *commutatum*, *polymorphum* and *depressum*. Of the other species, several are occasionally found on trees, but they all grow with equal facility on rocks or on the ground.

§ 1. TAMARISCINA.

1. *H. abietinum*, L. Sp. Pl. p. 1591; Hedw. Musc. Frond. 4. t. 32; M. P. 1.

Hab. Z_{1-2} in rupibus calcareis umbrosis, per Pyrenæos vulgatissimum, semper autem sterile.

2. *H. recognitum*, Hedw. Musc. Frond. 4. p. 92. t. 35.

Hab. Z_1 in Pyr. orientalibus; W. P. Schimper.

3. *H. tamariscinum*, Dill.; Hedw. Sp. Musc. t. 67. *H. proliferum*, L. Sp. Pl. p. 1590; M. P. 2.

Hab. Z_{0-3} in sylvaticis, passim.

§ 2. UMBRATA.

4. *H. splendens*, Hedw. Sp. Musc. p. 262. t. 67.

Hab. Z_{0-3} locis umbrosis humidiusculis: fertile nusquam vidi.

5. *H. umbratum*, Ehrh. Crypt. Exsicc. n. 66; Hedw. Sp. Musc. t. 67; Sullivant! Musci Allegh. n. 2; M. P. 3.

Hab. Z_2 in nemore obscuro juxta cataractam *la Cascade du Cœur* dict., in valle *du Lys* P. centr.; necnon in valle *Jéret* P. occ.

6. *H. Pyrenaicum*, Spruce in Musc. P. n. 4: caule procumbente subdiviso, divisionibus irregulariter pinnatis, ramisque *stuppea radiculosa brevi*, *pallida*, *pinnato-divisa*, obtectis; *foliis* patentibus, ovatis (ramorum ovato-lanceolatis) apiculatis acuminulatisve, margine reflexis, *argute et subduplicato-serratis*, *nervo tenui ultra medium evanescente* (rarissime nervis binis) *et plicis tribus striæformibus* instructis.

Hab. in summa zona sylvatica (Z_3) montis *Crabioules*, saxa cau-

libus implexis dense obtegens. In Alpibus Helveticis et Tyrolensibus viget, sec. cel. Schimper.

Caulis procumbens, subdivisus, divisiones irregulariter pinnatæ vel subbipinnatæ, ramique crocei, subcurvati, dense foliosi et inter folia radicibus pallidis, decompositis, planis, versus basin 2–4 cellulas latis, obsessi. *Folia* imbricata, patentia, ovata, apiculata et acuminulata, apice subtorta, concava, margine reflexa, argute et in parte superiori subduplicato-serrata; plicis tribus striæformibus, media nervum debilem, sæpe ramosum, rarissime duplicem, supra medium evanescentem involvente, instructa; e cellulis minoribus areolata, lutescentia: *ramulina* angustiora, plica media fere oblitterata et ex eo nervo manifestiori. *Flores et fructus* desiderantur.

Ab hoc differt *H. umbratum*, Ehrh., divisionibus bipinnatis, *ramulis gracillimis*; radiculis compressis, latioribus, e 5–6 cellularum seriebus conflatis; *foliis multo minoribus, magis patulis, caulem ramulosque haud velantibus*, plerumque nervis binis instructis.

TAB. I. 1. *rami pars augm.*; 2. *folium caulis*; 3. *ramuli augm.*; 4. *apex folii augm. circiter 240ies*; 5. *pars stuppæ radiculosæ interfoliaris pariter aucta*.

Obs. Although this comes so near *H. umbratum* in essential character, it has yet a very different habit, arising from the less divided stems and the much larger leaves, which are imbricated at such an angle as not to allow the stem to appear between them. All the states of *H. brevirostre* differ from it in the *leaves being contracted below the long acumen*, and especially in their being prolonged at the base into *two semicircular free auricles*, which are inflexed and embrace the stem*; they are also usually *squarrose* and furnished with *two short nerves*. *H. plicatum*, Schleich., is very similar in habit, and has the leaves plicato-striate in the same manner, but the latter are *subsecund*, with a *longer nerve*, their *margins entire* and most widely reflexed at about two-thirds of their length. *H. Kamounense*, Harv. (Hook. Icones, l. t. 24. f. 10), an Indian species, seems also to approach it very closely, differing chiefly in the *shorter, almost obsolete nerve, the less sharply toothed margins of the leaves*, and their more twisted apices, often describing two spires.

§ 3. SQUARROSA.

7. *H. brevirostre*, Ehrh. Pl. Exsicc. n. 85; Schwgr. Suppl. t. 225; M. P. 5.

Hab. Z_0-2 in umbrosis fere ubique, copiose fructiferum.

8. *H. triquetrum*, L. Sp. Pl. p. 1593; E. Bot. t. 1622; M. P. 7.

Hab. Z_0-3 in sylvaticis.

9. *H. squarrosum*, L. Sp. Pl. p. 1593; Dill. t. 39. f. 38.

Hab. Z_0-3 in sylvis, pascuis, etc., rarissime fructificans.

* This has not altogether escaped the notice of Schwaegrichen, who says of *H. brevirostre*, "*folia cordato-ovata angulis baseos lateralibus inflexis.*"

10. *H. loreum*, L. Sp. Pl. p. 1593; H. et T. ! Musc. Brit. p. 181. t. 26; M. P. 8.

Hab. Z_{1-2} in umbrosis.

§ 4. STELLATA.

11. *H. stellatum*, Schreb. Fl. Lips. p. 92; Schwgr. Suppl. t. 144.

Hab. Z_1 locis humidis, haud vulgatum.

12. *H. polymorphum*, Hedw. Sp. Musc. t. 66.

Hab. Z_{1-3} P. occ. et c. ad rupes calcareas. *Jurançon*; *Bagnères-de-Bigorre*, &c. In alpinis semper sterile invenitur.

13. *H. Halleri*, L. Diss. Musc. p. 34; Hedw. Musc. Frond. 4. t. 21; M. P. 58.

Hab. Z_2 P. occ. in regione media montis *Pic de Ger*, etiam circa *Cauterets*; P. c. loco *Labassère*: rupestre. "In Pyren. jugis depressis in planitiem excurrentibus;" Dufour apud Bridel Br. Un.

§ 5. HETEROPTERA.

14. *H. dimorphum*, Brid. Suppl. Musc. 2. p. 149; Grev. Scot. Cr. Fl. t. 160; M. P. 57.

Hab. Z_{2-3} locis umbrosissimis, terrestre; P. occ. circa *Cauterets*; P. c. *Lac Lehou* (Philippe!); P. or. *Mt. Canigou* et *Port Nègre* (Arnott!).

15. *H. heteropterum*, Bruch apud Schwgr. (sub *Pterogonio*): dioicum; caule prostrato, diviso, divisionibus subpinnatis; *foliis laxè imbricatis, erectiusculis vel subsecundis, obliquis, ovatis, subacuminatis, nunc acutis nunc obtusis, margine planis, subserratis, nervo perbrevis nonnunquam furcato instructis, dorso papillois*; pedicello lævi; capsula ovato-oblonga, cernua; *operculo rostrato, capsulam vix æquante*; calyptra dimidiata glabra; peristomio *Hypni*.

Musci Pyrenaici, 56. *Pterogonium heteropterum*, Bruch in Schwaegr. Suppl. 3. v. 1. t. 210 b; vix *Pterigynandrum h.*, Brid. Bryol. Univ. 2. p. 176. *Hypnum catenulatum*, H. et T. ! Musc. Brit. ed. 2. p. 160. t. 24; Hook. Eng. Flora, 5. P. 1. p. 81; non autem Schwgr. Suppl. 1. v. 1. p. 218; nec *Pterigyn. catenulatum*, Brid. Musc. Rec. 2. P. 1. p. 64. t. 5. f. 4.

Hab. Z_{1-2} ad saxa in sylvis Pyrenæorum centralium, sat frequens sed rarissime fructificans. Prope *B.-de-Bigorre* capsulis onustum legi 17 Octobris, 1845. In Hibernia ad *Powerscourt Waterfall*, ubi primus omnium beatus Taylor detexit. In Angliæ et Scotiæ plurimis locis repertum est. In monte *Vogeso* et Germania occidentali, teste Bruch, *l. c.*

Cæspites densi, implexi. *Caulis* prostratus, hic illic radicans, varie divisus; divisiones irregulariter pinnato-ramosæ, ramis alternis, ascendentibus, plurimo tempore subsecundis, simplicibus, subramosis, rarius pinnatis. *Folia* caulis divisionumque ovato-acuminata, in summo caule acumine sæpius valde elongato, acuta, basi decurrentia et e

marginibus inflexis semi-amplexicaulia; "aliorum ramorum erectiuscula, aliorum secunda" (Schwgr.), laxè et subquadrifarie imbricata, alia recta, alia oblique incurva, ovata, ovato-lanceolata et ovato-acuminata, quoad apicem nunc acuta nunc obtusa, margine plana; *omnia* denticulata, nervo perbrevis quartam folii partem ut plurimum emetiente, nunquam ad medium usque producto, nunc lato et obscuro, nunc ramoso vel e basi ipsa bifurcato, instructa; cellulis mediocribus, oblongis, prominulis areolata et dorso valde papillosa; in cæspitibus sterilibus sæpe pallida, flavescentia, in fertilibus autem fere semper saturate viridia. *Florescentia* dioica. *Caules masculi* cum fœmineis immixti, iis tenuiores: *flores* numerosi, alares, ovati, foliis 12 plus minus, ovatis, exterioribus obtusis, internis acuminatis, acumine torquato, enerviis, valde concavis, obscure denticulatis, areolatione laxiori; antheridiis haud copiosis, paraphysatis. *Fœminei floris* folia perichætialia sat numerosa, externa brevissima, interna elongata et flexuoso-acuminata, enervia, subdenticulata, laxè areolata, haud papillosa. *Vaginula* teres, viridis, apice tamen atro-rubens, archegoniis et paraphysibus numerosis perichætium haud æquantibus onusta. *Pedicellus* semuncialis, lævis, rufus. *Capsula* ovato-oblonga, cernua, e brunneo olivacea. *Peristomii externi* dentes 16, trabeculati, linea media exarati, pallidi: *interni* membrana carinato-sulcata, in processus totidem solidos, ciliis binis filiformibus interjectis, ultra medium fissa. *Annulus* duplex, revolubilis. *Operculum* e basi conica rostratum, rostro oblique curvato, capsulam fere æquans. *Calyptra* dimidiata, glabra. *Semina* congenerum.

Ab hoc differt *H. dimorphum*, Brid., *foliis caulis divisionumque primariarum squarrosis; ramis dense foliosis, foliis arcte appressis* "unde ramulorum facies teres" (Brid.), *latioribus*, obtusioribus, *nervis binis* tenuioribus et plerumque longioribus, e cellulis brevioribus areolatis, et maxime *operculo conico*.

Obs. I have been thus particular in my description of this disputed moss in the hope of finally settling its name and synonymy. The characteristic figure of Schwaegrichen, though representing a barren specimen, and his description, accurate as far as it goes, place it beyond a doubt that his *Pterogonium heteropterum* is the same plant as the *Hypnum catenulatum* of English authors; but that it cannot be identical with the *H. catenulatum* of Schwgr. will be obvious from the following considerations. The leaves differ from Schwgr.'s description of *H. catenulatum* in being *oblique*, decurrent at the base and slightly embracing the stem, the *margins plane* (by no means "stria utrinque marginali brevi," which implies a decidedly reflexed or recurved margin), *papillose and truly denticulate**, the *nerve very short*, not "ultra medium evanescente." Besides these discrepancies are the very important ones of a *dioicous inflorescence* and a *decidedly rostrate lid* †, not "conicum brevissimo rostello."

* The authors of 'Musc. Brit.' for want of examining with sufficient minuteness, supposed that the denticulation of the margins was only *apparent*, arising from the papillosity of the surface.

† Represented shorter in the 'Musc. Brit.' figure than in my Pyrenæan specimens, and in original ones from the authors.

Presuming the identity of our plant with the *Pterogonium heteropterum* of Schwaegrichen, and its diversity from the *Hypnum catenulatum* of the same author, to be sufficiently established, I have further to remark that the *Pterigyn. heteropterum* of Brid. l. c. is surely a different plant from that of Schwaegrichen; for it has "rami inordinate fasciculati," and "theca erecta oblonga, omnino *Pterigynandri*," to which is added "Inter *P. gracile* et *filiforme* intermedium." These characters point rather to a form of *P. filiforme*, with which species we find Schwaegrichen identifying it, at the close of his description, in these terms: "Hunc muscum propterea pingi curaveram, ut botanicorum curæ commendaretur et fructus completi exquirerentur; sed acceptis nuper a Bridelio speciminibus, illud a *Pt. filiformi* non differre convictus sum." He erred, however, in supposing his moss the same as Bridel's, and consequently a var. of *P. filiforme*, which may be excused him from the circumstance of his possessing only barren specimens.

It still remains to inquire what is the veritable *Hypnum catenulatum* of Bridel and Schwgr.; but I fear this question can only be settled by a reference to the herbaria of these authors. The moss published under that name in Schimper's 'Stirpes Normales,' &c. agrees with Schwaegrichen's description in the "folia obesa et mollia . . . stria utrinque marginali brevi," and in the nerve, &c., but the inflorescence is certainly *dioicous*, while Schwaegrichen, whom it is difficult to suppose mistaken on this point, states that of his moss to be *monoicous*. A moss agreeing perfectly with Schimper's has been found by Mr. Ibbotson on Pen-y-ghent in Yorkshire, and the *H. catenulatum* of Drummond's 'Musci Americani,' No. 219, is possibly not specifically distinct. These three mosses are all sterile, and their identification is consequently the more difficult, if not quite impossible. I gathered the same moss in the Pyrenees in numerous stations, extending between the extreme limits of my explorations to the westward and eastward, yet always sterile, which would be inconceivable in a monoicous species distributed over so wide a space. However, rather than propose a new name for it, I am willing for the present to receive it as *H. catenulatum*.

16. *H. catenulatum*, Brid.? Mant. Musc. p. 167; Schwgr.? Suppl. P. 2. p. 218. "*Leskea Vaucheri*, Schimp." M. P. 82.

Hab. Z₁^{sup.} in saxis arborumque radicibus per Pyrenæos occidentales et centrales, haud raro cum *Leskea attenuata* et *nervosa* sociatum.

I gave this moss in 'Musci Pyrenaici' as *Leskea Vaucheri*, Schimp., from a comparison with specimens under that name in Dr. Montagne's herb. at Paris; but I have since learnt that M. Schimper really intended by *Leskea Vaucheri* the species mentioned in this catalogue as *L. nervosa*, and it is therefore not improbable that the tuft I examined contained both species, for they frequently grow intermixed and are quite similar in habit. Very lately I have received from M. Schimper fertile specimens of *H. catenulatum*; the capsule and operculum are much of the same form as in *H. heteropterum*, and the processes of

the inner peristome are imperforate, not "quatuor lacunis notati," as described by Schwaegrichen.

§ 6. SERPENTIA.

17. *H. serpens*, L. Sp. Pl. p. 1596; E. Bot. t. 1037; M. P. 60.

Hab. Z_{0-2} in arboribus imis, &c.; in montibus sequente minus frequens.

18. *H. subtile*, Hedw. Musc. Frond. 4. t. 9 (sub *Leskea*); M. P. 61.

Hab. Z_{1-2} ad truncos vetustos, sat frequens; rarius ad rupes. *Forêt de Lhieris*; *Vallée de Lutour*, &c.

19. *H. Sprucii*, Bruch in litt. (sub *Leskea*); Spruce in Lond. Journal of Botany, 4. p. 180; M. P. 62. *Hypnum confervoides*, Drumm. ! Musc. Amer. n. 190 (ex parte): non Bridelii.

Hab. Z_2 P. occ. ♀ in rupium umbrosarum fissuris montis *Lizé* et vallis *Béost*; P. c. ♂ *Vallon de Courbettes* et *Forêt de Lhieris*, cæspitibus *Mnii serrati* immixtum.

The inflorescence of this species is truly *dioicous**, and from the circumstance of *female plants alone* being found in the *W. Pyrenees*, and *only male plants in the Central*, it may readily be conjectured that no fruit was observed.

§ 7. TENELLA.

20. *H. tenellum*, Dicks. Cr. Fasc. 4. t. 11. f. 12; M. P. 25.

Hab. Z_1 in muris rupibusque calcareis circa *Pau* et *B.-de-Bigorre*. *Mt. Ferrand*, P. or. (Arnott!).

§ 8. DEPRESSA.

21. *H. silesiacum*, P. Beauv. Prodr. d'Æth. p. 70; Schwgr. Suppl. t. 94; M. P. 46. *H. repens*, Poll. palat.; Duby, Bot. Gall. ed. 2. P. 2. p. 562.

Hab. Z_{1-3} ad truncos putrescentes per *Pyrenæos* præcipue occidentales.

In the *Pyrenees* I never observed this species but on rotten wood, but in Dec. 1847 I met with it on soft sandstone in *Arncliffe Wood*, *Eskdale*. All the other British specimens I have seen belong to the following species.

22. *H. Mühlenbeckii*, Schimp. ! mst.

Hab. Z_{2-3} in terra rupibusque subhumidis, rarissimum. *Lac de Séculéjo*. Inter pagos *Luz* et *Barèges*.

23. *H. depressum*, Bruch ! in Bot. Zeit. 1824, p. 763. *H. confertum* var. ζ . *depressum*, Brid. Br. Univ. 2. p. 767.

Hab. Z_1 P. c. *Vallon de Serris*, ad rupes calcareas.

* *Planta mascula* foeminea tenuior. *Flores* sparsi, cauli ramisque solute adhærentes. *Folia perichæatialia* sub-10, externa minuta, lanceolata, interna ovata brevi acumine, omnia serrata, enervia. *Antheridia* 2, ovalia, brevipedicellata, singula paraphysibus 2 stipata.

This species is abundant in woods on calcareous soil near Castle-Howard, but is always sterile.

24. *H. elegans*, Hook. Musc. Exot. t. 9; Schwgr. Suppl. t. 282 a. *H. planifolium*, Brid. ? Bryol. Univ. 2. p. 411.

Hab. Z₁₋₂ P. c. prope *B.-de-Bigorre*, ad terram (♀); *Bois de Sajust* prope *B.-de-Luchon*, ad rupes graniticas (♀ et ♂).

Mr. Wilson has lately found in Mr. Turner's herbarium fertile specimens of this (gathered near Bantry by Miss Hutchins, but confounded with *H. denticulatum*) which agree in every respect with the original specimen in Herb. Hook. (gathered by Menzies on the N.W. coast of America). He also suggests that *H. planifolium*, Brid., l. c., gathered by Lapylaie near Falaise, is the same species, but there are some discrepancies not easily reconcilable. For instance, our plant has the leaves remarkably deflexed at the apices so as to appear *secund in profile*, whereas Bridel says "folia recta;" but on the whole I admit that it is very probable he had the same species under his eye.

In the *Bois de Sajust* I found male and female plants intermixed. The former are very slender and elongated: the flowers are situated on the stem and the lower part of the branches, those near the base of the stem often fascicled, but the upper usually solitary; they consist of about ten ovato-lanceolate, shortly acuminate, concave leaves, and include about four paraphysate antheridia.

In April 1846 Mr. Borrer and myself gathered *H. elegans* on the sand-rocks in Eridge Park, Tunbridge Wells, and I have since met with it abundantly in the neighbourhood of Castle-Howard, in Eskdale, &c. Perhaps Dr. Taylor was the first who ascertained its existence in the British Isles and clearly distinguished it; Messrs Wilson and Mitten have also found it in several stations. It grows on decaying vegetable matter, on the earth or on rocks, *avoiding only such as are calcareous*, while *H. depressum*, its very near ally, is quite pertinacious in selecting a calcareous matrix. The former differs from the latter chiefly in the *more faintly toothed or quite entire leaves*, their *slenderer points* and closer more chlorophyllose areolation, but especially in the *pendulous capsule*. Both species are dioicous, scarcely ever fruiting, but propagating themselves by slender *deciduous flagelliform ramuli*, which spring from the stem in fascicles. These ramuli are sometimes so numerous as to be alone visible, and being clad with minute distant leaves, they give to the tufts the aspect of drawn-up *H. subtile*.

25. *H. trichophorum*, Spruce in mst. *Leskea pilifera*, Swartz! (ex herb. Smithii). *Neckera p.*, Musc. Pyr. 66. *H. denticulatum* var. *Donnianum*, Drumm.! Musc. Am. n. 165 (*nonnull. exemplo-rum*): non *H. Donnianum*, Sm.

Hab. Z₂ ad latera scopulorum graniticorum versus terram spectantia, in umbrosissimis vallis *Jéret*, P. occ.

Inflorescence monoicous: flowers fascicled, the male and female in separate fascicles. *Peristome very pale*, especially the outer; the inner cloven to $\frac{2}{3}$ of its length: *processes perforated, between the articu-*

lations, nearly throughout their length: *cilia* none or quite rudimentary.

In 'Musci Pyr.' I placed this moss along with the first section of *Neckera* (*Omalia*, Brid.), to which it approaches very much in habit; but the *Omalia* differ from it so essentially in some of their characters, that I feel compelled to withdraw it from their society. *O. complanata* has the capsule very narrow-mouthed, the peristome consequently small and the outer teeth remarkably slender; *the processes of the inner are entire, very slender and fragile, and the basal membrane rises very little above the mouth of the capsule* (so that the moss might be considered a true *Neckera* with as much justice as *N. pumila*, from which I am not certain that it should be separated). The inflorescence is *dioicous*. *O. trichomanoides* has a wider-mouthed capsule; the inner peristome firmer, *reddish*, the basal membrane = $\frac{1}{4}$ th of the whole, *the processes deeply carinate but not lacunose*. The inflorescence is *monoicous*, and the flowers are mostly solitary.

Hypnum trichophorum differs from both these, not only in the peristome, but in the *flaccid* irregularly divided *stems*; the *symmetrical leaves*, which are not 4-stichous, nor (as in the *Omalia*) so decurved at the apices as to make the branches appear channeled when viewed from below; the *long-necked capsule*; the *conical lid*, &c. In nearly all these characters it is closely allied to *H. denticulatum* and *pulchellum*, both of which have not unfrequently a nearly symmetrical capsule. *H. elegans* is intermediate as to the form of its leaves between *H. denticulatum* and *H. trichophorum*.

It is with great reluctance I change Swartz's specific name, but this is rendered compulsory by the removal of the species into *Hypnum*, where there is already a "*piliferum*." I shall not, however, quarrel with those who are disposed to raise this section into a separate genus, and restore to the species its original name.

26. *H. pulchellum*, Dicks. ! Fasc. 2. p. 13. t. 5. f. 6; Herb. Sicc. fasc. 9. n. 22. *H. nitidulum*, Wahl. Fl. Lapp. p. 370; M. P. 63.

Hab. Z_{2-4} ad truncos putridos, in rupium fissuris, &c., P. occ. et c. *V. de Jéret*; *Esquierry*, &c. *En montant au Lac Lehou* (Philippe!).

27. *H. denticulatum*, L. Sp. Pl. p. 1595; Hedw. Musc. Frond. 4. t. 3.

Hab. Z_{0-2} ad ligna putrida. A sequente *florescentia monoica* distinctum.

28. *H. sylvaticum*, L. Syst. Veg. p. 950; Schwgr. Suppl. t. 87; M. P. 64 (ex parte).

Hab. Z_{6-4} ad ligna putrida, in rupibus subhumidis, &c.

When growing in water or in moist places, the leaves of this species often put forth radicles from or near their apices.

29. *H. undulatum*, L. Sp. Pl. p. 1589; Schwgr. Suppl. t. 282; M. P. 65.

Hab. Z_{2-3} in umbrosis humidiusculis, rarius. *Vallée de Lesponne.* *Mt. Crabioules.*

§ 9. RUGOSA.

30. *H. rugosum*, Ehrh. Dec. n. 291. *H. rugulosum*, H. et T. !
Musc. Brit. p. 187. t. 26; M. P. 42.

Hab. $Z_{1\text{sup.}-2}$ ad saxa calcarea per totos Pyrenæos.

§ 10. PLICATA.

31. *H. plicatum*, Schleich. Cent. 4. n. 27; Schwgr. Suppl. 1. P. 2. p. 301; M. P. 6.

Hab. Z_{3-4} ad saxa præcipue granitica in alpinis, plerumque secus ovilia, sociis *Leskea incurvata* et *Tortula aciphylla*. In valle *Arise* P. c. fructif. invenit cl. Philippe !

Paraphylla are present in this species, which completely cover the stem between the leaves with a short felt. The largest are leaflike, though many times smaller than the true leaves, lanceolate or lanceolato-subulate, entire or with one or two teeth near the base. In their more rudimentary form they simulate radicles, being one or more cellules in breadth and slightly and irregularly branched. Hence the species may be considered to have some affinity with *H. filicinum* on the one hand, and with *H. Pyrenaicum* on the other.

§ 11. ADUNCA.

32. *H. riparium*, L. Sp. Pl. p. 1595; Hedw. Musc. Frond. 4. t. 3.

Hab. Z_1 P. c. in ripis flum. *Adour* prope *Bagnères* (Philippe!).

33. *H. fluitans*, L. Fl. Suec. 1074; Hedw. Musc. Frond. t. 36.

Hab. P. or. in monte *Canigou* (Arnott!). In Pyrenæis nusquam ipse inveni.

34. *H. palustre*, L. Sp. Pl. p. 1593; Eng. Bot. t. 1655; M. P. 37.

Hab. Z_{1-2} in rivulis saxis emersis adhærens.

35. *H. falcatum*, Brid. Musc. Rec. 2. P. 2. p. 63; Schwgr. Suppl. t. 145; M. P. 38.

Hab. Z_2 in scaturiginosis calcareis juxta rivulum *Ruisseau d'Ardalos* dictum, in valle *Lesponne*.—An mera sequentis forma?

36. *H. fluviatile*, Sw. Musc. Suec. p. 63; Hedw. Sp. Musc. t. 81.

Hab. Z_1 P. occ. in rivulis supra pagum *Jurançon*; P. c. in ripis fl. *Adour* prope *Bagnères* (Philippe!). (*Pic St. Loup* prope *Montpellier*: Arnott!)

37. *H. filicinum*, L. Sp. Pl. p. 1590; Hedw. Sp. Musc. t. 76; M. P. 39. *H. conspurcatum*, Brid. ! in hb. Requien.

Hab. Z_{1-2} in saxis udiuseculis præcipue rivulorum.

“*Var. foliis rigidis, nervo crassissimo instructis;*” M. P. 40.
H. Vallisclausæ, Brid. ! Br. Univ. 2. p. 534.

Hab. in fontibus profundis secus ripas flum. *Adour*, in vicinia pagi *Asté*, P. c.

Specimens gathered by Messrs. Arnott and Requier at *Vauchuse* agree well with Bridel’s description, and are quite the same as my own from *Asté*. In ‘*Musci Pyren.*’ I had considered *H. filicinum* and *fluviatile* not distinct, relying on Bridel’s description of the latter (Br. Univ. p. 532), where the *falcato-secund leaves* (rarely seen in *real H. fluviatile*) are strongly insisted on. *H. fluviatile verum* is, however, readily distinguished from *H. filicinum* by the *monoicous inflorescence*.

38. *H. commutatum*, Hedw. Musc. Frond. 4. t. 26.

Hab. Z₁₋₂ per Pyrenæos in scaturiginosis calcareis.

Var. alpestre, Schimp. in litt.; P. c. *Vallon d’Arise* (Philippe !)
P. or. *Port Nègre* (Arnott !).

39. *H. uncinatum*, Hedw. Musc. Frond. 4. t. 5; M. P. 41.

Hab. Z₂₋₃ ad saxa et ligna putrida.

§ 12. CUPRESSIFORMIA.

40. *H. Crista-castrensis*, L. Sp. Pl. p. 1591; Hedw. Sp. Musc. t. 76; M. P. 43.

Hab. Z₂ in Pyr. centralium sylvaticis, ad cataractam dict. *la Cascade du Cœur* in valle *du Lys*, etiam in valle *Lesponne*; in P. occ. loco *Pont d’Espagne*.

41. *H. molluscum*, Hedw. Musc. Frond. 4. p. 56. t. 22; M. P. 44.

Hab. Z₀₋₅ in rupibus arborumque basi.

“*Var. terrestre, foliis insigniter serratis plerumque striatis;*” M. P. 45.

Hab. ad terram in sylvis circa *Pau*, locis *Parc de Pau*, *Bois de Gan*, &c.

In the Pyrenees, this species sports into innumerable forms, sometimes simulating *H. flagellare* in the laxly spreading, scarcely at all secund leaves, which are shorter than ordinary, more sharply serrated and distinctly striated; at other times it puts off the characteristic pectinato-pinnate ramification and assumes the habit of *H. callichrous*, to which also it approaches in the form of the leaves and their faintly-toothed margins. A small tuft of male plants was gathered in Z₅ (*Port de Cauterets*) growing with *Encalypta rhabdocarpa*.

42. *H. flagellare*, Dicks. Crypt. Fasc. 2. p. 12; H. et T. ! Musc. Brit. t. 25; M. P. 9.

Hab. Z_{1 sup.} P. c. ad cataractam inter pagum *Labassère* et fontem dict. *la fontaine sulfureuse*: nusquam alias vidi.

43. *H. pratense*, Koch (fide Bruch); Spruce in Lond. Journ. of Bot. 4. p. 177; M. P. 51.

Hab. Z_1 per totos Pyrenæos, in graminosis montium humiliorum: sterile solum ipse vidi. Ad pedem monticuli *Bédât* prope *B.-de-Bigorre* fructif. invenit cl. Philippe!

44. *H. callichrous*, Brid. Br. Univ. 2. p. 631; M. P. 47.

Hab. Z_{2-4} P. occ. in rup. irroratis ad pontem dict. *le Pont d'Espagne*, non procul a *Cauterets*; P. c. in fauce *la Gorge d'Esquierry* dicta, etiam in montibus *Maladetta* et *Crabioules*, necnon *en montant au Lac Lehou* (Philippe!).

45. *H. incurvatum*, Schrad. Crypt. Gew. n. 80; Schwgr. Suppl. t. 94; M. P. 48.

Hab. Z_1 per Pyr. centr. et occidentales: pulcherrime ad saxa umbrosa prope *Oloron*.

46. *H. resupinatum*, Tayl. ! in schedis recentioribus. *H. multiflorum*, ejusd. in Fl. Hibern. P. 2. p. 46; M. P. 49. *H. polyanthos*, E. Bot. t. 1664.

Hab. Z_{0-1} P. occ. ad arbores prope *Pau*; etiam in Agro Syrtico prope Aq. Tarbellicas.

The two localities here cited are the only ones noted in the Pyrenees, but in Britain this species is nearly as frequent as the following.

47. *H. cupressiforme*, L. Sp. Pl. p. 1592; Hedw. Musc. Frond. 4. t. 23; M. P. 50.

Hab. Z_{0-4} passim.

48. *H. Haldanianum*, Grev. ! in Ann. Lyc. Hist. Nat. Novi-Eborac. 1. p. 275. t. 23 (e specim. a cel. auctore communicatis); Sulliv. ! Musc. Allegh. n. 14; M. P. 52. *H. pulchrum*, Drumm. ! Musc. Amer. n. 180. *H. cylindricum*, B. et S. !

Hab. Z_1 inf. P. c. ad terram et arborum radices in sylvis siccioribus circa *B.-de-Bigorre* (*Bois de Laguillaste et d'Asté*).

Inflorescence monoicous: male flowers confined to the stem. The teeth of the outer peristome and the processes of the inner are remarkably attenuated, and the latter (as well as the cilia) are papillose upwards. There is considerable variation in the form of the apex of the leaf: in Sullivant's specimens the leaves are merely *acute*; in Drummond's they are decidedly *acuminate*; and my Pyrenean specimens are intermediate in this respect.

§ 13. CUSPIDATA.

49. *H. cuspidatum*, L. Sp. Pl. p. 1595. *H. palustre*, &c., Dill. t. 39. f. 34.

Hab. Z_{0-3} in pascuis rupibusque subhumidis: sterile semper vidi.

50. *H. Schreberi*, Willd. Fl. Berol. p. 325; E. Bot. t. 1621; M. P. 53.

Hab. Z₀₋₃ in umbrosis humidis : in Zona subalpina sola copiosiss. fructificans.

51. *H. purum*, L. Sp. Pl. p. 1594; E. Bot. t. 1599; M. P. 54.

Hab. Z₀₋₂ in sylvis, &c.

§ 14. JULACEA.

52. *H. julaceum*, Schwgr. in Schultes Reis. &c. (sub *Leskea*); M. P. 55. *H. moniliforme*, Wahl. Fl. Lapp. p. 376. t. 24.

Hab. Z₂₋₄ in rupestribus per Pyrenæos, rarius tamen et sterile. *Mont Lizé. Lac de Séculéjo* (♀). *Lac Lehou* (var. foliis longius apiculatis). *V. d'Eynes* (Arnott!).—"Folia apiculo minuto plerumque incurvato semper reperi;" Musc. Pyr. l. c.

§ 15. SALEBROSA.

53. *H. albicans*, Neck. Meth. Musc. p. 180; E. Bot. t. 1300.

Hab. Z₀₋₁ in arenosis, rarum. *St. Pandelon. B.-de-Bigorre.*

54. *H. glareosum*, Bruch. ! in litt.; M. P. 29. *H. salebrosum*, H. et T. Musc. Brit. p. 166. t. Suppl. 5 (ex parte).

Hab. Z₁ P. occ. ad saxa in valle *Béost*; P. c. in arenosis ad basin monticuli *Bédât*, et in saxosis sylvæ *Bois de Gouerdère* dictæ: loca calcarea amat.

In the *Bois de Gouerdère* this grows intermixed with *H. salebrosum*, from which it is distinguished at sight by its leaves being paler and more silky, with longer more flexuose points and very faintly toothed margins; but the most important character is the dioicous inflorescence. It is a very abundant species in the neighbourhood of York and Castle-Howard, but is rarely fertile: it never grows on trees. *H. salebrosum* I have seen in England only on trees in woods near Kirkham Abbey, in the vale of the Yorkshire Derwent.

55. *H. salebrosum*, Hoffm. Fl. Germ. 2. p. 74; Brid. Br. Univ. 2. p. 477; Grev. ! Scott. Cr. Fl. t. 284; M. P. 30.

Hab. Z₁₋₂ P. c. ad saxa et supra ligna putrida circa *Bagnères-de-Luchon*, locis *Bois de Gouerdère* et *Vallée du Lys*, copiose; circa *B.-de-Bigorre*, rarius.

56. *H. campestre*, Bruch ! in litt.; M. P. 31.

Hab. Z₁ in graminosis circa thermas de *Salut* dictas, prope *B.-de-Bigorre*. Inter *H. salebrosum* et *rutabulum* medium.

§ 16. RUTABULA.

57. *H. pseudoplumosum*, Brid. Musc. Rec. 2. P. 2. p. 108; M. P. 36. *H. plumosum*, H. et T. ! Musc. Brit. p. 162. t. 25.

Hab. Z₁₋₂ in rivulorum saxis: socio consuetissimo *H. populeo*. *Var.* (*H. subsphæricarpon*, Schleich. exs. cent. 2. n. 46); in Pyrenæis (Bridel).

58. *H. populeum*, Hedw. Sp. Musc. t. 70; M. P. 27.

Hab. Z₁₋₂ ad saxa ex alveo emersa rivulorum.

59. *H. reflexum*, Starke; W. et Mohr. Bot. Tasch. p. 306 et 476; Schwgr. Suppl. t. 143; M. P. 26.

Hab. Z₃ P. c. in altioribus montis *Crabioules*, saxatile; P. or. *Port Nègre* (Arnott!).

60. *H. Starkii*, Brid. Musc. Rec. 2. p. 167 et Bryol. Univ. 2. p. 595; M. P. 34.

Hab. Z₂₋₄ P. occ. ad terram in monte *Lizé*, et juxta pontem dict. *d'Espagne*, socio *H. dimorpho*; P. c. ad rupes argillaceo-schistosas loco *Port de Benasque*! (Arnott!).

The leaves of this species, especially in smaller and fertile specimens, are often subfalcate, and it then approaches very closely *H. paradoxum*, Hook. f. et Wils. (Crypt. Ant. p. 113. t. 155. f. 2), its representative of the southern hemisphere.

61. *H. velutinum*, L. Sp. Pl. p. 1595; Hedw. Musc. Frond. 4. t. 27; M. P. 35.

Hab. Z₀₋₃ ad terram, &c. in umbrosioribus.

62. *H. rivulare*, Bruch! in litt.; M. P. 33.

Hab. Z₁₋₃ ad rivulorum lapides, P. c. circa *B.-de-Bigorre* (*Forêt de Transoubât*, &c.); P. occ. *Gave de Valentin*.

63. *H. rutabulum*, L. Sp. Pl. p. 1590; Hedw. Musc. Frond. 4. t. 12; M. P. 32.

Hab. Z₁₋₃ in terra, &c. fere ubique.

64. *H. illecebrum*, L. Sp. Pl. p. 1594; Schwgr. Suppl. 1. P. 2. p. 255; M. P. 16. *H. blandum*, Lyell! in Hook. Fl. Lond. cum icona.

Hab. Z₀₋₁ P. occ. in arenosis inter herbas circa *Pau*, *St. Sever* et *Aguas Tarbellicas*; in montes editiores haud ascendens.

65. *H. caespitosum*, Wils.! E. Bot. Suppl. t. 2878; M. P. 17.

Hab. Z₀ ad arborum radices in pratis irriguis arenaque suffusis prope *Aq. Tarbellicas*.

§ 17. PRÆLONGA.

66. *H. Teesdalii*, Sm. Fl. Brit. 3. p. 1291; E. Bot. t. 202; M. P. 24. *H. laxepennatum*, Brid.! in hb. Requier (= *H. curvisetum*, Brid. = *Pylaisæa radicans*, Brid.; ex cl. Arnott). *H. Schleicheri* γ. *obscurum*, Brid.? Br. Univ. 2. p. 405.

Hab. Z₁ ad rivulorum exsiccatis lapides, P. c. locis *Elysée Cottin*, *Labassère*, &c.; P. occ. circa *Gélos*.

67. *H. pumilum*, Wils.! in E. Bot. Suppl. t. 2942; M. P. 23.

Hab. Z₀₋₁ P. occ. et centr. in solo calcareo sylvarum, sterile; ♀ prope *Pau* et *B.-de-Bigorre*; ♂ in arenosis prope *Dax*.

68. *H. Swartzii*, Turn. Musc. Hib. p. 151. t. 14. *H. prælongum*, M. P. 22 (*ex parte*).

Hab. Z₀₋₁ in terra rupibusque udiuseculis.

69. *H. prælongum*, L. Sp. Pl. p. 1591 ; Hedw. Musc. Frond. 4. t. 29 ; M. P. 22 (*ex parte*).

Hab. Z_0-1 ad terram et truncos, priori multo minus frequens.

70. *H. piliferum*, Schreb. Fl. Lips. p. 91 ; Hedw. Musc. Frond. 4. t. 14 ; M. P. 21.

Hab. Z_1 ^{sup.} in virgultis, haud frequens : ad cataractam dict. *la Cascade du gros Hêtre* prope *les Eaux Bonnes*, pulcherrime fructiferum. Loca calcarea amat, vix tamen iis proprium.

71. *H. Vaucheri*, Lesquereux ! mst. : dioicum ; caule prostrato, diviso ; *divisionibus* ascendentibus, *apice attenuato decurvo sæpe radican- tibus*, irregulariter bipinnatis ; *ramulis cuspidatis, subsecundis* ; *foliis* suberectis, dense imbricatis, *caulinis ovatis ex apice obtusiusculo longe subulato-acuminatis*, ramulinis lanceolatis in acumen brevius sensim attenuatis, omnibus concavis, *marginè inferiori reflexis*, apicem versus *subserratis*, nervo simplici furcata- tove ad medium evanescente ; *pedicello scabro* ; *capsula ovata*, in- clinata, subcernua ; *operculo* inclinato, *conico-acuminato v. sub- rostrato*, apice obtuso, *capsula dimidium vix excedente* ; calyptra dimidiata, glabra ; peristomii interni processibus pertusis, ciliis interjectis.—M. P. 19.

Hab. Z_1 ^{sup.} -2 P. centr. prope *B.-de-Bigorre* in vallibus *Serris* et *Castelloubon*, saxa calcarea dense vestiens ; sociis *H. crassinervio* et *Isothecio lutescente*. Hyeme fructificat.—*Var.* β . *minus* (M. P. 20) in imis truncis saxisque graniticis ad ripas rivuli *Gave du Lys* umbrosissimas, prope *B.-de-Luchon* : nonnisi sterile vidi.

Simile *H. crassinervio*, Tayl., cui tamen sunt *folia breviter acumi- nata, marginè tota reflexa v. explanata, argute serrata, nervo crasso instructa*, capsula longior, *rostrumque operculi duplo longius*. *H. piliferum*, Schreb., *statura majore, divisionibus bifariam pinnatis* ; *foliis* laxioribus, majoribus, *caulinis ex apice obtusissimo naviculari longius attenuato-acuminatis* (acumine= $\frac{1}{2}$ fol.) vix serrulatis ; *operculo duplo longiori* et peristomio interno minus profunde fisso dignoscendum est. *H. cirrhosum*, Schwgr. Suppl. 1. P. 2. p. 214, habitu *H. Vaucheri* haud absimile, folia iis *H. piliferi* fere longius acuminata habet.

72. *H. tenuicaule*, Spruce ; dioicum, ascendens, *parce ramo- sum*, ramis subdichotomis, subparallelis ; *foliis nitidis, erecto- patulis, lanceolatis, longe acuminatis, marginè inferiori reflexis, vix serrulatis*, nervo folii dimidium raro attingente, nonnunquam ob- soletum.

Hab. Z_1 P. c. in arborum radicibus sylvæ *Bois de Lagaillaste* dictæ in vicinia *B.-de-Bigorre*, ♀ sola, sterilis ; sociis *H. Halda- niano* et *Isothecio repente*.

Planta pusilla (= *H. incurvatum*), cæspitosa. *Rami* pauci, supe- riores tamen nonnunquam fastigiati. *Folia* uniformia, flavescenti- viridia, nitida, sicco statu apice patula, areolatione e cellulis parvulis

elongatis; caulina haud raro nervo perbrevis furcatoque instructa. *Flores feminei*: folia perichætialia externa minima, rotundata, apiculata; interiora majora, e basi ovato-lanceolata, capillari-acuminata; intima parvula, subulata capillariave; omnia enervia, integerrima. Archegonia sub-5, paraphysibus longiora. *Planta muscula* non aderat.

Habitu fere *Isothecii myosuroidis* formæ pusillæ, differt *foliis nitidis, minime argute serratis*. Ab *H. Vaucheri* *foliis caulinis haud ex obtuso acuminatis et nervo breviori distinctum*.

73. *H. crassinervium*, Tayl. ! in Fl. Hibern. 2. p. 43; Wils. ! in E. Bot. Suppl. t. 2706; M. P. 18.

Hab. $Z_1^{\text{sup.}}$ ad rupes calcareas, haud infrequens. *Les Eaux Bonnes*; *B.-de-Bigorre*, &c.

§ 18. LONGIROSTRIA.

74. *H. murale*, Hedw. Musc. Frond. 4. t. 30; M. P. 15.

Hab. Z_1 ad saxa calcarea.

75. *H. confertum*, Dicks. Fasc. Crypt. 4. p. 17; Schwgr. Suppl. t. 90; M. P. 14.

Hab. Z_{0-1} in saxosis montium humiliorum; in arborum truncis ad rivuli *Luy* ripas prope Aq. Tarbellicas (*forma major*).

76. *H. Megapolitanum*, W. et M. Bot. Tasch. p. 326; Brid. Br. Univ. 2. p. 491.

Hab. Z_0 P. occ. in arenosis prope Aq. Tarbellicas.

77. *H. rusciforme*, Weiss. Crypt. Goett. p. 225; M. P. 13. *H. riparioides*, Hedw. Musc. Frond. 4. t. 13. *H. atlanticum*, Brid. ! in hb. Requien.

Hab. Z_1 in rivulis ad saxa lignaque demersa.

78. *H. longirostre*, Ehrh. Pl. Exsicc. n. 75. *H. striatum*, Schreb.; Hedw. Musc. Frond. 4. t. 13.

Hab. Z_{0-1} locis sylvaticis.

79. *H. striatulum*, Spruce in Musci Pyr. 12: dioicum; *caule prostrato*, diviso; divisionibus subpinnatis, ramis ascendentibus, simplicibus compositisque; *foliis nitidis*, patentibus, caulinis cordato-triquetris, ramulinis cordato-ovatis, omnibus longe acuminatis, striatis, margine præter ad basin planis, serratis, nervo valido paulo ultra medium desinente; pedicello lævi; operculo e basi convexo-conica rostrato, capsulam ovali-oblongam subcernuam subæquante; calyptra glabra.

Hab. Z_1 P. occ. et c. in valle d'Ossau et circa Bagnères-de-Bigorre (locis Bédât, Vallon de Serris, &c.) in saxis calcareis quibus arcte adnascitur. In Pyrenæis Asturiacis invenit Durieu. In Angliæ et Hiberniæ austrinis cl. Wilson, Thwaites et Mitten detexerunt. Ad auctumni finem fructificat.

Caulis prostratus, varie divisus, subpinnato-ramosus, ramis ascendentibus, simplicibus, ramosis vel subpinnatis. *Folia* patentia, cor-

dato-triquetra (ramulorum cordato-ovata), longe acuminata, plicato-striata, argute serrata, margine utrinque ad basin reflexa superne plana, nervo crasso paulo ultra medium desinente instructa, areolatione mediocri, amœne viridia v. fuscescentia, nitida. *Florescentia* dioica. *Flores masculi* ad caulem et ramos plantæ tenuioris nati; *folia perigonialia* sat numerosa, ovato-acuminata, concava, integerima, enervia vel rarius quadam nervi umbra prædita; *antheridia* circiter 20, brevi-pedicellata; *paraphyses* illis numerosiores sublongioresque. *Flores feminei* folio caulino longiores; *folia perichætialia* circiter 17, erecta, *externa* minuta, rotundato-ovata, enervia, *intima* oblonga, in acumen flexuosum, serratum et ad basin nonnunquam inciso-serratum subito attenuata, nervo rudimentario in acumen producto instructa; *archegonia* paraphysibus numerosis stipata. *Vaginula* oblonga, teres. *Pedicellus* uncialis, aut paulo longior, lævis, siccitate dextrorsum contortus. *Capsula* ovali-oblonga, inclinato-subcernua, badia. *Operculum* e basi convexo-conica rostratum, capsulæ longitudine. *Peristomium*: *dentes externi* sedecim, subulato-acuminati, linea media exarati: *interius* membrana pallidior, in processus totidem carinatos et in carina sæpe perforatos, ciliis 2–3-nis, haud ferme fragilibus, interjectis, apice usque ad $\frac{2}{3}$ fissi.

Ab *H. longirostri* quod proximum refert, *statura duplo minori*; *caule prostrato*; *foliis nitidis, longius acuminatis*, minus conspicue striatis, *angulum 45°–50° cum ramo efformantibus* (nec ut in *H. striato* fere squarrosis); *capsula breviori, nequaquam horizontaliter cernua*, et peristomio interno profundius fisso, ciliis validioribus, distinguitur.

Obs. Specimens gathered by Mr. Wilson near Killarney have the leaves sometimes more widely spreading, and therefore approach *H. longirostre* more nearly; still the habit is the same as in my Pyrenæan plant, namely very nearly that of *H. velutinoides*, Bruch, which however differs essentially from *H. striatulum* in the rough pedicel and the form of its leaves. Mr. Mitten's specimens, gathered in Sussex, about the roots of trees in a chalky soil, have much of the external aspect of *Isothecium myosuroides*.

80. *H. strigosum*, Hoffm. Deut. Fl. 2. p. 76; M. P. 11. *H. pulchellum*, Hedw. Sp. Musc. t. 68.

Hab. Z₃ P. occ. ad terram in alpinis prope Cauterets (Mont Lizé; V. de Combascon).

†*H. circinatum*, Brid. Mant. Musc. p. 165.

Hab. ad muros prope Burdigalam. Circa Vallem Clausam (Arnott!).

In all probability this species exists also in the Pyrenees, though hitherto not observed there.

Tribus 2. ISOTHECIACEÆ.

2. *Climacium*, W. et Mohr.

81. *C. dendroides*, L. Sp. Pl. p. 1593 (sub *Hypno*); M. P. 90; B. et S. Bryol. Eur. fasc. 16.

Hab. Z_{0-2} in umbrosis humidis; circa *B.-de-Bigorre* haud raro fertile.

3. *Isothecium*, Brid. Br. Univ. 2. p. 355.

Obs. The four sections into which I divide this genus are separated from each other by such wide intervals, that I shall not be surprised if at some future period they be placed in at least as many different genera. The family of Hypnoid mosses requires to be completely rearranged, and this can only be done well by a person perfectly familiar with exotic species.

Isoth. rufescens is found only on calcareous rock, and its stems are mostly incrustated below with carbonate of lime. *I. lutescens* seems to grow on no other rock than limestone, but it is also occasionally found on trees. The three species of the last section prefer to grow on the living bark of trees, and *I. striatum* selects the slenderest twigs of subalpine shrubs and humble trees.

§ 1. DENDROIDEA.

82. *I. alopecurum*, L. Sp. Pl. p. 1594 (sub *Hypno*); Schwgr. Suppl. t. 227; M. P. 10.

Hab. Z_1 in rupibus subhumidis, haud vulgare.

83. *I. Myurum*, Pollich, Pl. Pal. 3. n. 1054. f. 8 (sub *Hypno*); M. P. 73. *Hyp. curvatum*, Sw.; H. et T. ! Musc. Brit. p. 102. t. 25.

Hab. Z_{0-3} in sylvaticis, ad saxa et arborum truncos.

“*Var. ramis incrassatis vix curvatis, operculo breviori;*” M. P. 74; in rupibus terra obtectis pinetorum circa pontem *d’Espagne* dictum; etiam secus lacum *Séculéjo*.

84. *I. myosuroides*, L. Sp. Pl. p. 1596 (sub *Hypno*); E. Bot. t. 1567; M. P. 75.

Hab. Z_{0-3} in umbrosis præcipue secus rivulos, saxatile et arbustivum.—Folia nonnunquam subsecunda.

§ 2. SERICEA.

85. *I. aureum*, Lagasca in Ann. de Cienc. Nat. n. 14 (sub *Hypno*); Brid. Br. Un. 2. p. 469.

Hab. Z_3 P. c. in rupibus prope lacum Espingo, sterile (♀), socia *Tayloria serrata*.

The leaves are incorrectly described by Bridel as nerveless: in my specimens, as in others gathered by M. Schimper in the Sierra Morena, the leaves are (like those of *I. lutescens*) *strongly 3-plicate, the middle fold involving the nerve*.

86. *I. lutescens*, Huds. Fl. Angl. (sub *Hypno*). *H. lutescens*, Hedw. Musc. Frond. 4. t. 16; M. P. 88.

Hab. Z_1 in terra rupibusque calcareis, necnon in arboribus.—Circa *B.-de-Bigorre* (locis *Elysée Cottin*, *Bois d’Asté*, &c.) capsulis ovato-cylindricis fere erectis ludit.

The *scabrous setæ*, the *tristriate leaves*, and the whole *habit* of this species bring it so near *I. sericeum*, that in a natural distribution I apprehend they must be placed in the same genus. Besides, if we compare the fructification, we shall not find very great differences. The *capsule* of *I. lutescens* (as above intimated) is sometimes elongated and *very nearly erect*, although never quite symmetrical. The *inner peristome*, as in *I. sericeum* and *Philippianum*, has the *cilia* either wholly or in part absorbed at the period of maturity, although capsules not quite ripe show slender 2-3-nate cilia. (I have observed similar circumstances in *I. polyanthum*.) The chief difference from *I. sericeum* is in the *lacunose processes* and their very slight granulation. The annulus is double. The inner membrane of the capsule projects beyond its mouth the breadth of the annulus before it is divided. The teeth are strongly trabeculate within and enveloped in a delicate membrane.

87. *I. sericeum*, L. Sp. Pl. p. 1595 (sub *Hypno*); M. P. 76. *Leskea* s., Hedw. Musc. Frond. 4. t. 17.

Hab. Z₀₋₂ in arboribus, &c. vulgatissimum.

88. *I. Philippianum*, Spruce in Musc. Pyr. 77: dioicum; caule prostrato, radicante, diviso; divisionibus pinnato-ramosis, ramis erectis, plerumque simplicibus; *foliis* dense imbricatis, *erectis*, *lanceolato-acuminatis*, striatis, toto ambitu minute denticulatis, *nervo percurrente*; *pedicello lævi*, *rarius scabriusculo*; capsula erecta, symmetrica, ovato-cylindrica; operculo breviter rostrato, rostro subcurvato; *calyptra* dimidiata, *glabra*.

Hab. Z₁ sup. P. c. ad saxa calcarea in umbrosis montis *Lhieris*, prope *Bagnères-de-Bigorre*; etiam in rupibus graniticis sylvæ *Bois de Gouerdère* dictæ, prope *B.-de-Luchon*. Auctumno et hyemis initio fructificat.

Plantæ latas plagas efficientes. *Caulis* 2-6 uncias longus, pinnatus, ramis suberectis, simplicibus, rarius furcatis, hic illic radicans et isthinc divisiones pinnato-ramosas edens. *Folia* densa, erecta, superiora nonnunquam (in sicco saltem statu) subsecunda, omnia lanceolata seu ovato-lanceolata, acuminata, acumine caulorum tenuiori, plicato-striata, toto ambitu minute denticulata, nervo continuo instructa, e cellulis minimis lineari-elongatis areolata, viridia aut auro subnitentia. *Florescentia* dioica: *flores masculos* non habui: *feminei* cauligeni, elongati, foliis numerosis, 24 et pluribus, erectis, arcte vaginantibus, interioribus acumine setaceo, flexuoso terminatis, leviter plicatis, obsolete nervosis, paraphyses copiosissimas archegoniis longiores complectentibus. *Vaginula* oblongo-cylindrica, viridis. *Pedicellus* uncialis, lævis vel rarius et inferne præcipue scabriusculus, siccitate dextrorsum contortus. *Capsula* erecta, symmetrica, ovato-cylindrica, microstoma, pallida. *Peristomii externi* dentes subulati, quadrangulares, transverse *septati* (haud trabeculati) ad basin versus tantum linea media exarati, sparsim papilloso, pallidi: *interni* membrana profunde (usque ad $\frac{1}{2}$) fissa, lutescens; processibus dentes fere

æquantibus, lineari-subulatis, solidis, papillis minutissimis opacis ob-
sitis, unde fuligine quasi oblitis, ciliis interjectis nullis seu rudimen-
tariis. *Annulus* e duplici serie cellularum conflatus. *Operculum* bre-
viter rostratum, rostro subinclinato. *Calyptra* dimidiata, glabra, cap-
sulam fere totam obtegens. *Semina* minutissima, minute granulosa.

Ab *Isothecio sericeo nitore minus spectabili*, ramis siccitate vix cur-
vatis, *folii nervo perdurante, pedicello sublævi, calyptra (etiam juvenili)*
glaberrima, peristomii dentibus minime (I. sericei instar) e septis in
facie externa internaque prominulis *trabeculatis*, notisque aliis differt.
Ab *I. lutescente foliis solidinerviis, capsula erecta symmetrica*, ut et
peristomii interni configuratione distinguitur.

TAB. II. 1, 2, 3. *folia aucta*; 4. *apex folii magis aucta*; 5. *capsula*
aucta; 6. *peristomii pars*; 7. *ejusdem dens externus a latere visus*,
240-ies auct.; 8. *dens peristomii Isothecii sericei a latere visus, ad id.*
augm.

§ 3. RUFESCENTIA.

89. *I. rufescens*, Dicks. Cr. Fasc. 3. t. 8. f. 4 (sub *Hypno*);
M. P. 78.

Hab. Z₁ sup. in monte *Lhieris* et juxta aquas dict. *les Eaux*
Chaudes, ad rupes calcareas irroratas. In Pyrenæis (Bridel).

90. *I. chryseum*, Schwgr. in Schultes Reise auf den Glockner,
2. p. 364 (sub *Hypno*). *Leskea rufescens* β. *chrysea*, Brid. Br.
Univ. 2. p. 286.

Hab. Z₂₋₄ P. occ. et c. in rupium humidarum fissuris. *Col de*
Louvie. Esquierry. Bois de Sajust.

This is the moss mentioned in my 'Musci and Hepaticæ of Tees-
dale' (Annals, 1844) under no. 91, *Hypnum multiflorum*, Tayl., of
which, in deference to Dr. Taylor's opinion, I considered it a form.
It is however quite distinct from both that species and *I. rufescens*,
and is not like the latter confined to calcareous rocks.

§ 4. POLYANTHA.

91. *I. polyanthum*, Schreb. Fl. Lips. p. 97 (sub *Hypno*);
M. P. 79. *Leskea p.*, Hedw. Musc. Frond. 4. t. 2.

Hab. Z₁ P. c. in Tiliæ unicæ trunco juxta thermas oppidi *Ba-*
gnères-de-Luchon; necnon in sepibus prope *Arreau*: rarius.

92. *I. repens*, Brid. Suppl. Musc. p. 131 (sub *Pterigynandro*);
M. P. 80; Schwgr. Suppl. t. 27, et t. 246 B (sub *Neckera*).

Hab. Z₁ inf. P. occ. et c. in arborum præsertim Castanearum
radicibus circa *Pau* et *B.-de-Bigorre*.

Peristomium duplex: dentes externi pallidi: interius ad basin usque
in cilia brunnea, tenuissima, sæpe apice inter se anastomosantia, e
cellularum serie singula (rarius ex parte duplici) conflata, fissum.

93. *I. striatum*, Schwgr. Suppl. t. 27 (sub *Pterogonio*) et
t. 246 A. (sub *Neckera*); M. P. 81.

Hab. Z₂ P. c. pulcherrime fructiferum in fruticum ramulis ad

latera montis *Lhieris*, ubi detexerunt cl. Philippe et De Lugo ! Sterile infra lacum *Espingo* ipse inveni. *Perist. duplex*, ac in præcedente.

4. *Leskea*, Hedw.

94. *L. nervosa*, Brid. Mant. Musc. p. 128 (sub *Pterigynandro*). *Pt. longifolium*, Schleich. ! Cent. 4. n. 8. "*Leskea Frælichii*, Brid. ? ;" M. P. 83.

Hab. Z_1 P. occ. et c. in arboribus imis saxisque graniticis, circa *Cauterets* et *Pierrefitte* præcipue. *Bords de l'Adour à B.-de-Bigorre* (Philippe !).

95. *L. incurvata*, Hedw. Sp. Musc. t. 53 ; M. P. 84. *H. atrovirens*, Dicks. Cr. Fasc. 2. p. 10.

Hab. Z_{3-5} in saxis graniticis præcipue secus ovilia. *Mt. Ma-ladetta*, *Mt. Lizé*, &c.—Subter nivibus fructus maturat.

96. *L. polycarpa*, Ehrh. Crypt. Exsicc. n. 96 ; M. P. 85. *Hypnum medium*, Dicks. ; H. et T. ! Musc. Brit. p. 154. t. 24.

Hab. Z_{0-1} P. occ. et c. in truncis imis secus ripas rivuli *Luy*, prope Aq. Tarbellicas ; etiam juxta fl. *Adour*, *Bagnères* ! (Philippe !).

97. *L. rostrata*, Hedw. Sp. Musc. t. 55 ; Sullivant ! Musci Allegh. n. 63 ; M. P. 86.

Hab. Z_1 ^{sup.} in sylvaticis ad rupes inque fruticum radicibus. *Vallon de Serris* ; *Superbagnères*, &c.

98. *L. longifolia*, Hartm. ! in litt. (sub *Anomodonte*) ; M. P. 87.

Hab. Z_1 P. c. in *Carpini Betuli* truncis secus rivulum *Gave du Lys*, socia *L. attenuata* ; etiam ad saxa in monticulo *Camp de César* dicto prope *B.-de-Bigorre*.

I possess specimens of this gathered by Messrs. Gardener and Scott in Forfarshire.

99. *L. attenuata*, Schreb. Fl. Lips. p. 100 (sub *Hypno*) ; Hedw. Musc. Frond. 1. t. 12 ; Sullivant ! Musci Allegh. n. 61 ; M. P. 88.

Hab. Z_{1-2} in regione *Fagi sylvaticæ* per totos Pyrenæos, saxa calcarea et truncos veteriores dense obtegens.

100. *L. viticulosa*, L. Sp. Pl. p. 1592 (sub *Hypno*) ; M. P. 89. *Neckera v.*, Hedw. Sp. Musc. t. 48.

Hab. Z_{0-2} in saxis sylvarum.

I do not think this can be separated generically from *L. attenuata*. The two approach very closely in the form and texture of the leaves : both have the same pallid peristome (internal and external), the only difference being that in the latter the sporular sac extends a little beyond the mouth of the capsule, before it is divided into the processes constituting the inner peristome. In *L. viticulosa* the inner peristome is cloven quite down to the mouth of the capsule, and be-

sides the slender processes (or rather cilia) there are interposed *ci-liola*, but exceedingly short (= about two cellules).

5. *Entodon*, C. Müller in Linnæa, 1844, Band 2. Heft 6.

101. *E. cladorrhizans*, Hedw. Sp. Musc. t. 47 (sub *Neckera*). *Neckera c.*, Sullivant ! Musci Allegh. n. 77. *Isoth. c.*, M. P. 71.

Hab. Z_1 sup. P. c. in ulmo unica ad ripas rivuli dict. *Gave du Lys*.

102. *E. insidiosus*, Mont. ! in Ann. des Sciences Nat. Dec. 1843, tom. 20. t. 15. f. 1 (sub *Isothecio*) ; M. P. 72. *Entodon Montagnei*, C. Müll. l. c.

Hab. Z_1 sup. in terra saxisque calcareis circa *B.-de-Bigorre*, locis *Elysée Cottin*, *Medous*, &c. : semper absque fructu.

Very soon after my return to England from the Pyrenees, I discovered this beautiful species in several stations around Castle-Howard, growing always in calcareous soil, and often accompanied by *Hypnum recognitum*.

Tribus 3. NECKERACEÆ.

6. *Neckera*, Hedw. (ex parte).

(*Neckera Distichia*, Brid. Br. Univ. 2. p. 238.)

103. *N. crispa*, L. Sp. Pl. 1589 (sub *Hypno*) ; Hedw. Fund. Musc. 2. t. 14 ; M. P. 70.

Hab. Z_{1-2} in rupibus arboribusque passim.

104. *N. pumila*, Hedw. Musc. Frond. 3. t. 20 ; M. P. 69.

Hab. Z_1 P. c. in arborum cortice sylvæ *Forêt de l'Escaladieu* dictæ : nusquam alias vidi.

7. *Omalia*, Brid. Br. Univ. 2. p. 325.

105. *O. complanata*, L. Sp. Pl. p. 1588 (sub *Hypno*). *Leskea c.*, Hedw. Fund. Musc. 2. t. 10. *Neckera c.*, M. P. 67.

Hab. Z_{0-2} in fruticibus præcipue *Buxis*.

106. *O. trichomanoides*, Schreb. Fl. Lips. p. 88 (sub *Hypno*). *Hypnum tr.*, H. et T. ! Musc. Brit. p. 152. t. 24. *Neckera tr.*, M. P. 68.

Hab. Z_{0-1} in umbrosis humidis ad arborum radices ; haud frequens.

Tribus 4. HOOKERIACEÆ.

8. *Hookeria*, Smith.

107. *H. lucens*, L. Sp. Pl. p. 1589 (sub *Hypno*) ; E. Bot. t. 1902 ; M. P. 91.

Hab. Z_{1-2} P. c. in sylvaticis secus rivulos, rarissima. Circa *B.-de-Bigorre*. *Lac de Séculéjo*.

Tribus 5. PTEROGONIACEÆ.

9. *Leptodon*, Web., Tab. Syn. Musc.

108. *L. Smithii*, Dicks. Fasc. 2. p. 10. t. 5. f. 4 (sub *Hypno*).

Hab. Z_{0-1} in arborum cortice circa *Pau*, &c. In Pyr. orientibus (Arnott ! Montagne !). Circa Burdigalam, socia *Cryphæa heteromalla*, legi.

10. *Pterogonium*, Swartz.

109. *P. filiforme*, Hedw. Musc. Frond. 4. t. 7 ; M. P. 92.

Hab. Z_{1-3} ad saxa et arbores, circa *Cauterets* præcipue, frequens.

“ *Var. foliis secundis. P. heteropterum*, Brid. ? Br. Univ. 2. p. 176. *Hab.* in rupibus secus lacum *Espingo* prope *B.-de-Luchon* ;” M. P. 93.

110. *P. gracile*, L. Syst. Veg. p. 952 (sub *Hypno*) ; M. P. 94. *Pterigynandrum gr.*, Hedw. Musc. Frond. 4. t. 6.

Hab. Z_{0-2} in saxis Pyrenæorum, semper sterile ; in arboribus sylvæ *Lespéron* prope Aq. Tarbellicas Agri Syrtici fructiferum legi 20 Novembris, 1845.

The leaves of this species, besides being *papillose* from the projecting cellules, are *tuberculate on the back in the upper half* ; the tubercles arranged with some regularity parallel to the sides of the leaf, three or four cellules apart, and springing from the points where four cellules meet.

111. *P.?* *subenervium*, Spruce ; dioicum ; *caule* prostrato, *vage bipinnato*, ramis ascendentibus, subparallelis ; *foliis e basi patula apice surrectis, ovatis oblongo-ovatisve, acuminatis, concavis, margine inferiori leviter reflexis, integerrimis, nervo rudimentario vix ullo, areolatione guttulata*.

Hab. Z_1 in arborum cortice prope *B.-de-Bigorre* et *Pau* : ♀ sola, sterilis.

Caules $\frac{1}{2}$ –1 unc., intricati, hic illic radiculos rufos emittentes. *Folia* saturate viridia, integerrima, margine tamen inferiori e cellularum parietibus prominulis subundulata ; nervo brevissimo, longitudine latitudinem haud excedente ; siccando appressa, apice autem recurva patulave : in ramis tenuioribus nonnunquam adsunt folia angustiora, acumine cirrhoso chlorophyllo carente instructa. *Cellulæ* discretæ ; inferiores latitudine tertiam partem long. habent, superiores vix dimidiam ; *reflexus vero rotundatæ, minores, unde folium ibidem magis opacum videtur. Flores* *fæminei* ad caulem et ramos primarios nati ; *folia perichætialia*, intimis minoribus *subulatis* exceptis, ovato-lanceolata, acuminata, serrata, *cellulis marginalibus curvatis*, enervia. *Archegonia crassa*, numerosa, 10 circiter, *paraphysibus omnino destituta*.

Folia iis *Pt. gracilis* haud absimilia, *epapillosa autem et apice an-*

gustiora sunt. Cæterum ramos nec incurvos nec fasciculatos habet. *Clasmatodon pusillus*, Hook. et Wils. in Drumm. Mosses of S. States of N. America (*Regmatodon parvulus*, Hampe, Icones, t. 14) habitu et magnitudine ut etiam foliis margine basali reflexis, areolatione guttulata, &c., similis, certe differt *florescentia monoica et foliis latioribus ad medium usque nervatis.*

11. *Leucodon*, Schwgr.

112. *L. sciuroides*, L. Sp. Pl. p. 1596 (sub *Hypno*) ; Schwgr. Suppl. t. 125.

Hab. Z_{0-1} in arborum truncis ; copiose fructificans.

12. *Cyrtopus*, Brid. Bryol. Univ. 2. p. 235.

113. *C. curtispendus*, L. Sp. Pl. p. 1594 (sub *Hypno*). *Anomodon c.*, H. et T. ! Musc. Brit. ed. 1. p. 79. t. 22 (1818). *Antitrichia c.*, Brid. Mant. Musc. p. 136 (1819) et Br. Univ. 2. p. 223.

Hab. Z_1 ad saxa et truncos. Fertilem in sylva *Forêt de Transoubât* dicta invenit cl. Philippe !

This species agrees well enough in habit and character with some of the exotic species of *Cyrtopus*, e. g. *C. acuminatus*, Hook. Musc. Exot. t. 151, and I therefore place it along with them rather than in *Anomodon* or *Antitrichia*, both of which genera have been founded on incorrect views of the structure of the inner peristome. The cilia neither spring *from the sides of the teeth*, as stated in 'Muscologia Britannica,' nor are they *opposite to the teeth*, as Bridel says ; on the contrary, they are (as in all mosses) *a continuation of the sporular sac*, and they alternate with the teeth. They are the most slender and delicate I have seen in any moss, and consist either of a single series of cellules throughout, or here and there of a double series, when they are often perforated. There are sometimes rudimentary *ciliola* (solitary or twin) between them.

Tribus 6. FABRONIACEÆ.

13. *Fabronia*, Raddi.

114. *F. pusilla*, Raddi, Act. Florent. ; Schwgr. Suppl. t. 99.

Hab. Pyr. or. prope *Rodez* (Arnott !) ; etiam "in rupibus cavis ad *St. Martin* in radicibus montis *Canigou*" (Mont. in Arch. de Bot. tom. 1). "Circa *Dax* Aquitanix" (Grateloup in Brid. Br. Univ.).

Tribus 7. ANACAMPTODONTÆ.

14. *Anacamptodon*, Brid.

115. *A. splachnoides*, Brid. Mant. Musc. p. 136 ; Sulliv. ! Musci Allegh. n. 82 ; M. P. 97. *Neckera s.*, Schwgr. Suppl. t. 82.

Hab. Z_1 sup. P. c. *Vallée du Lys*, in trunco *Carpini Betuli* unico.

Tribus 8. CRYPHÆACEÆ.

15. *Cryphæa*, Brid.

116. *C. heteromalla*, Hedw. Musc. Frond. 3. t. 15 (sub *Neckera*);
M. P. 96.

Hab. Z_{0-1} corticicola per Pyrenæos humiliores.

[To be continued.]

XXXIV.—*Observations on the Animal of Kellia rubra*, by WILLIAM CLARK, Esq., in a Letter to Professor EDWARD FORBES.

To Richard Taylor, Esq.

DEAR SIR,

THE interesting letter I herewith send you relates to the curious little bivalve mollusk *Kellia rubra*, upon the animal of which some important observations were communicated by Mr. Alder to the number of the 'Annals' for September last. In the 15th part of the 'History of British Mollusca,' by Mr. Hanley and myself, full use is made of Mr. Alder's notes, and also of valuable manuscript notes on the *Kellia* kindly communicated to us by Mr. Clark. The discrepancies between the statements of different observers as detailed in our work have induced Mr. Clark to turn his immediate attention to the subject, and the results are contained in the following letter. Their value is such that I grudge the delaying of the communication of them to the public until the conclusion of the 'History,' when we mean to add abundant new matter in supplementary notes.

I need scarcely say that the statements of Mr. Clark go towards confirming the union of Recluz's genus *Poronia* with *Kellia*, the view taken in the 'History of British Mollusca.' M. Deshayes's drawing of the animal of *Kellia Geoffroyi* (in the Mollusques d'Algérie) exhibits the same conformation of tube observed by Mr. Alder first and since by Mr. Clark in *Kellia rubra*.

Most truly yours,

EDWARD FORBES.

7 Norfolk Crescent, Bath,
7th March, 1849.

MY DEAR SIR,

It gives me pleasure to have it in my power to send you what I think is a correct account of the malacology of *Kellia rubra*.

After I had written to you on the 4th instant, I became dissatisfied, and I determined to make an attempt at once to settle the point, as to the tube of *Kellia rubra* being open underneath or otherwise; for which purpose I wrote to a friend to obtain from certain rocks, four miles from Exmouth, a parcel of *Fucus*

pygmæus, and send it to Bath in a moist state with a small phial of sea-water. It arrived yesterday by the post, and I found therein twelve specimens of *Kellia rubra*, which being placed in a watch-glass in sea-water showed themselves as lively as if examined at Exmouth. By the superior appliances used I at once saw what I had overlooked at Exmouth, and that Mr. Alder is perfectly right in stating the tube to be open below; all the animals repeatedly inserted the foot into the canal, and by thus displacing its sides, showed distinctly it was an open fold of the membrane; but the moment the foot was withdrawn, it reverted to its usual perfect tube-like aspect; indeed the most accomplished observer might be deceived, as it appears M. Philippi was. In fact this canal is a mere prolongation of the mantle, which is *entirely* open for more than half the ventral range, for the working of the foot and byssal apparatus.

But Mr. Alder is mistaken in supposing the tube-like fold to be for branchial purposes; no currents, at least branchial ones, enter therein or issue therefrom; it is a fold merely subservient to locomotion; this I perceived to be the case in a very short time, as I found the movements of the foot and tube-like canal to be nearly isochronal and dependent on each other, as when the foot was extended and *fixed* for a forward movement, the tube was also exerted, and by its muscular retractive power, in contemporaneous action with the foot, the shell was advanced in progression. It will now be asked, where then is the branchial aperture? This I have also satisfactorily discovered; it is the *posterior opening* which has passed for the anus, and is in reality a considerable elongated oval fissure, having its periphery slightly thickened or margined, and divided from the rima magna of the byssus and foot by a strong, narrow, transverse septum; from the termination of this opening the mantle is closed to the umbones; within this fissure I distinctly saw a *part* of the *points of the branchiæ*, and it was regularly dilated and contracted as the currents of sea-water were received, and after aëration of the circulating fluid expelled, in a similar manner to the action of systole and diastole. I must now speak of the anus, which I had also the good fortune to discover; it is placed at the posterior end of, and under the branchial aperture, and is a very minute, and for a part of its length, a disunited pendulous tube; its orifice is not one-tenth part of the size of the branchial opening; from this internal tube I repeatedly saw the rejectamenta expelled in small cylindrical light yellow or grayish pellets, which, falling within the cavity of the fissure, were instantly ejected; this oval aperture cannot even be called sessile, it is only a slit, serving as a common canal, for supplying the branchiæ with water and for the passage of the fæces; these are the only *two* openings in the

mantle, one for the foot, and one in common, for branchiæ and anus.

It must not be supposed that I have mistaken the functions of this fissure, and that it only belongs to the anal apparatus. *This is not the case; it is beyond doubt a common cavity for two distinct purposes, viz. anal and branchial.*

Thus this apparently strangely-formed animal turns out to be very similar to most of the bivalves, having the branchial and anal openings close together, where they ought to be, at the posterior end, and the anterior tube-like fold being nothing more than an aid to the foot in locomotion. I should not be at all surprised if the tube of *Kellia suborbicularis*, when closely examined (as it shall be), turns out to be an open canal; but whether this is the case or not, it is not for branchial, but locomotive uses.

From this examination it results, that the only essential difference between the two species is, that the one is *viviparous* and the other *oviparous*. You will now be able to judge if the genus *Poronia* must be adopted.

In the twelve specimens no young were found, as in the summer-time; I therefore conclude that "*Alma Venus*," as Lucretius styles the goddess, does not influence the self-sufficing loves of *these mollusca* until

..... "species patefacta est verna diei,
Et reserata viget genitabilis aura Favonî."

I am, my dear Sir, most truly yours,

Ed. Forbes, Esq.

WILLIAM CLARK.

XXXV.—*Descriptions of Aphides*. By FRANCIS WALKER, F.L.S.

[Continued from p. 53.]

61. *Aphis Ribis*.

Aphis Ribis, Linn. Syst. Nat. ii. 733. 1; Faun. Suec. 975; Gmel. ed. Syst. Nat. i. 2201; Fabr. Syst. Ent. 734. 5; Sp. Ins. ii. 385; Ent. Syst. iv. 211. 7; Syst. Rhyn. 295. 7; Frisch, Ins. ii. 9. t. 14; Réaum. Ins. iii. 281–350. t. 22. f. 7–10; Hausm. Ill. Mag. i. 437. 2; Leuwenh. Arc. ep. 90. 545. t. 548; Blanck. Ins. 164. t. 14. f. D. 2; Schrank, Faun. Boic. ii. 1. 108. 1195; Sir Oswald Mosley, Gard. Chron. i. 628; Kalt. Mon. Pfl. i. 39. 26.

Ribifex, Amyot, Ann. Soc. Ent. 2^{me} série, v. 476.

This *Aphis* feeds on *Ribis rubrum*, *R. nigrum*, *R. alpinum*, *R. grossularia*, and *R. uva crispa*, from March till November.

The viviparous wingless female. In the spring and when very young it is dark olive-green, oval, short, and plump: the feelers

are yellow with brown tips, and not half the length of the body : the eyes are black : the nectaries are white, and about one-twelfth of the length of the body.

1st var. The body is mottled with paler green : the feelers are nearly all white : the eyes are dark brown.

2nd var. The nectaries are pale green with brown tips, and about one-seventh of the length of the body.

It attains its full size in April, and is then greenish yellow, oval, convex, and slightly hairy above : there is a rim on each side of the body, and two vivid green lines along the back : the feelers are almost white with the exception of four black rings, and hardly half the length of the body : the mouth is very pale green ; its tip and the eyes are brown : the nectaries are pale straw-colour with brown tips, and about one-sixth of the length of the body : the legs are very pale green ; the feet and the tips of the shanks are brown.

3rd var. Yellowish green.

4th var. Grass-green.

5th var. The limbs are white ; the feelers are **more than half** of the length of the body, and the nectaries are **about one-fifth** of its length.

6th var. Bright yellow : the limbs are white : the feelers are a little shorter than the body : the eyes, the tip of the mouth, and the feet are black : the nectaries are one-fourth of the length of the body.

7th var. In the autumn and when it is young it is pale yellow and half transparent : the tips of the joints of the feelers, the tip of the mouth, and the feet are black. When full-grown it is yellow, convex, smooth, shining, oval, or nearly elliptic : the feelers are a little shorter than the body : the eyes are red : the nectaries are whitish with black tips, and about one-sixth of the length of the body : the legs are whitish ; the knees are gray ; the feet and the tips of the shanks are black.

8th var. Like the preceding, but the body is almost white.

9th var. Like the preceding, but with a lively green stripe down the middle of the body.

10th var. The feelers are much longer than the body.

11th var. Bright yellow : the limbs are pale yellow : the feelers are a little longer than the body ; the tips of their joints, the eyes, and the tip of the mouth are black : the nectaries have black tips, and are as long as one-fifth of the body : the knees and the tips of the shanks are gray : the feet are black.

12th var. Greenish white.

13th var. Nearly white.

It varies much in breadth and in outline ; some of the insects are slender and spindle-shaped, others are stout and elliptical or

oval. During the spring and the early part of summer it abounds under the red swollen leaves, and like many of the clustering species is the favourite food of the grubs of the ladybirds and of the *Syrphi*.

The viviparous winged female. While a pupa it is pale green ; the limbs are almost white ; the feelers are as long as the body ; the tips of some of the joints are pale brown : the eyes are dark red : the nectaries are rather more than one-fifth of the length of the body : the feet and the tips of the shanks are brown.

1st var. Greenish white.

2nd var. Nearly white.

3rd var. Grass-green.

4th var. Bright yellow, nearly elliptical, and having a vivid green stripe along the back : the eyes are red : the limbs are pale yellow or almost white.

The wings are unfolded in May, and the insect is then yellow and slightly varied with green : the head, the chest and the breast are brown : there is a large black spot near the tip of the abdomen, and a row of small black spots on each side : the feelers are brown, and longer than the body : the eyes are black : the mouth is pale yellow with a black tip : the nectaries have also black tips, and are nearly one-fifth of the length of the body : the legs are dull yellow ; the feet and the tips of the thighs and of the shanks are black : the wings are colourless, and very much longer than the body : the wing-ribs are very pale yellow ; the wing-brands and the veins are brown.

5th var. The head and the chest are buff : the abdomen is pale green varied with darker colour : the feelers are black, pale green towards the base ; the base of the third joint is pale yellow : the eyes are dark brown : the tip of the mouth is brown : the nectaries are pale yellow with brown tips, and nearly one-fourth of the length of the body : the legs are pale yellow ; the knees, and the tips of the thighs and of the shanks are brown : the wing-ribs are pale green ; the rib-veins are buff ; the wing-brands are dark buff.

6th var. The head, the chest and the abdomen are black : the feelers are black, yellow at the base, and a little shorter than the body.

7th var. Yellow : the back of the head is brown : the chest is streaked with dull red : there are transverse black spots with dark green edges on the back of the abdomen : the feelers are black, and a little longer than the abdomen : the nectaries are pale yellow, and about one-eighth of the length of the body.

8th var. Yellow : there is a broad brown band across the fore-chest : the middle-chest is brown : the breast is black : the abdomen has a large quadrate black spot on its disc, and a row

of small black spots on each side: the feelers are black, and nearly as long as the body: the mouth is pale yellow; its tip and the eyes are black: the nectaries are spindle-shaped, dull yellow, darker towards the base and at the tips, and hardly one-fifth of the length of the body: the legs are pale yellow; the hind-thighs, excepting the base, the feet, and the tips of the other thighs and of the shanks, are black: the wing-ribs, the rib-veins, and the wing-brands are pale yellow; the other veins are pale brown. This, like its predecessor, the wingless female, almost disappears during some part of the summer and the autumn, but a solitary little individual may still be seen here and there beneath the leaves.

The oviparous wingless female. This lives in October and in the beginning of November, when it lays its eggs on the shoots of the currant: it is elliptical, olive-green, mottled with pale yellow: there is a large green spot on each side of the abdomen by the nectaries: the feelers are yellow, black towards the tips, and longer than the body: the mouth is pale yellow; its tip and the eyes are black: the nectaries are pale yellow with black tips, and as long as one-fourth of the body: the legs are pale yellow; the knees, the feet, and the tips of the shanks are black; the hind-shanks are shaded with pale brown.

1st var. Yellowish green.

2nd var. Yellowish white.

3rd var. A black band round the middle of each hind-shank.

The winged male. It pairs with the oviparous female before the end of October. The head and the chest are black: the abdomen is dull yellow, with a few short slight bands across its back: the feelers are rather thick till near their tips, and almost as long as the body: the mouth is yellow with a black tip: the nectaries are black, and as long as one-sixth of the body: the legs are yellow; the hind-thighs, the feet, and the tips of the other thighs and of the shanks are black: the wing-ribs are yellow; the wing-brands and the veins are brown.

1st var. The fore-chest beneath its borders above, and the abdomen are dull greenish yellow; the latter has a row of black dots on each side: the nectaries are as long as one-eighth of the body: the hind-thighs are pale yellow towards the base.

62. *Aphis Galeopsidis*, Kalténbach.

Aphis Galeopsidis, Kalt. Mon. Pfl. i. 35. 23.

This is a very elegant insect: it is hairy like *A. Avellanae* and *A. tetrahoda*, but in other characters it differs widely from these two species. It feeds from February to October on *Galeopsis tetrahit*, *G. bifida*, *Lamium album*, *L. purpureum*, *L. amplexicaule*, *Polygonum Persicaria*, *P. lapathifolium*, *P. hydropiper*, *P. laxi-*

sporum, *Heracleum sphondylium*, *Plantago lanceolata*, *Stachys sylvatica*, *Tussilago Farfara*, *T. petasites*, and *Potentilla anserina*.

The front is hairy and somewhat notched: the first joint of the feelers has on the inner side of its tip a slight process which is most developed in the wingless female. It is common in the neighbourhood of London and of Lancaster, and Mr. Hardy has found it near Newcastle.

The viviparous wingless female. This is small, hairy, elliptical, rather narrow and flat, almost transparent, white or tinged with a very pale green or straw-colour: the eyes are dark brown: the mouth is white with a black tip, and reaches the middle hips: the feelers are slender, setaceous, hairy, much longer than the body; their tips are brown; the fourth joint is much shorter than the third; the fifth is shorter than the fourth; the sixth is rather more than one-fourth of the length of the fifth; the seventh is nearly as long as the third: the eyes are black: the nectaries are rather more than one-fourth of the length of the body; they are somewhat thicker towards the tips which are black: the legs are long, slender and hairy: the feet are black. The young are narrow and linear. It is infested by an *Allotria*.

1st var. Pale green with two rows of transverse vivid green spots along the back.

2nd var. The nectaries are not more than one-twelfth of the length of the body.

3rd var. The feelers are rather longer than the body: the nectaries are about one-ninth of its length.

4th var. The body and the limbs are white: the eyes, the tips of the feelers, of the mouth, of the nectaries and of the feet are black: the nectaries are one-sixth of the length of the body.

5th var. Very pale rose-colour, or pale yellow tinged with pale red, not shining: there is a deep red stripe down the middle of the body: the head is white: the feelers are white, and much shorter than the body; the tips of some of the latter joints are black: the mouth is white; its tip and the eyes are black: the nectaries are white with black tips, and about one-sixth of the length of the body: the legs are white; the tips of the feet are black.

6th var. Greenish white with two very large vivid green spots near the base of the nectaries.

7th var. The body is white: the feelers are a little longer than the body: the eyes, the tip of the mouth, and the tips of the shanks and of the feet are black: the nectaries are nearly one-third of the length of the body.

8th var. The body is pale yellow: the feelers are black towards the tips, and a little longer than the body: the mouth is pale yellow; its tip and the eyes are black: the nectaries are also pale

yellow with black tips, and about one-third of the length of the body: the feet are black.

The viviparous winged female. While a pupa it resembles the wingless female in colour, and the rudiments of its wings are white, but when these organs are unfolded it is pale greenish yellow: the feelers are black, pale green at the base, and as long as the body: the fourth joint is much less than half the length of the third; the fifth is shorter than the fourth; the sixth is as long as the fifth; the seventh is as long as the fourth: the eyes are dark red: the mouth is pale green; its tip is black: the disc of the chest and that of the breast are dark green: the abdomen is very pale yellow with transverse broken bright green bands: the nectaries are pale yellow, and nearly one-sixth of the length of the body; their tips are black: the legs are pale greenish yellow, long and slender; the knees, the feet, and the tips of the shanks are black: the wings are colourless, and much longer than the body; the wing-ribs and the rib-veins are pale yellow, the wing-brands are nearly colourless: the veins are brown; the first and the second veins diverge, but the second and the third are nearly parallel to each other; the first fork of the third vein is a little before one-third and the second after two-thirds of its length; the fourth vein is much curved, and the angle of the brand whence it springs is very slight.

1st var. Dull yellowish green: the feelers are brown, white towards the tips: the disc of the chest and that of the breast are black: the abdomen is pale yellowish green, and on its disc there are a few small green marks and one large square dark green spot: the nectaries are pale yellowish green, and nearly one-fourth of the length of the body; their tips are black: the wing-brands are very pale brown.

2nd var. Pale greenish white: the feelers are much longer than the body; their tips are white: the discs of the head, of the chest and of the breast are brown or black, and there is also a brown or black spot on each side of the chest: the abdomen is traversed by black bands; the first and the second are narrow; the third and the fourth are broad: the eyes are dark brown: the nectaries are nearly white, and not more than one-tenth of the length of the body: the legs are pale yellow; the tips of the thighs are brown; the feet and the tips of the shanks are black: the wing-ribs are white; the wing-brands are gray; the veins are black. The pupa is all white except the eyes and the feet which are brown.

3rd var. While a pupa the chest is buff, and the rudimentary wings are white.

4th var. While a pupa it is pale greenish yellow or pale saffron, long-elliptic, rather flat, smooth, not shining: there is a green

stripe along the back, or a white stripe with a black line on each side of it : the feelers are pale yellow, pale green at the base, black towards the tips, and much shorter than the body : the rudimentary wings are pale green : the mouth is pale yellow ; its tip and the eyes are black : the nectaries are nearly as long as one-sixth of the body ; their tips are black : the legs are pale yellow ; the thighs are pale green ; the tips of the feet are black.

The oviparous wingless female. The body is pale yellow, elliptical, and convex : the abdomen is lengthened behind : the feelers are black towards their tips, and a little shorter than the body ; the tip of the mouth and the eyes are black : the nectaries have black tips, and are as long as one-fourth of the body : the knees, the feet and the tips of the shanks are also black.

1st var. The body is red : the limbs are pale yellow : the feelers are black towards their tips, and as long as the body : the tip of the mouth and the eyes are black : the nectaries have black tips, and are as long as one-fourth of the body : the feet and the tips of the shanks are black.

Length of the body 1 line ; of the wings $2\frac{1}{2}$ lines.

63. *Aphis Abietina*, n. s.

The viviparous wingless female. This is oval, green, convex, rather dull, and half a line in length : the head and the limbs are paler and sometimes tinged with yellow : the front of the head is convex in the middle, but concave on each side, from whence there is a small protuberance extending to the base of the feelers : the feelers are brown towards the tips and about half the length of the body ; the inner side of the first joint is convex, and has no process ; the fourth joint is more than half the length of the third ; the fifth is much shorter than the fourth ; the sixth is a little shorter than the fifth ; the seventh is longer than the sixth : the eyes are dull red : the tip of the mouth is brown : the nectaries have brown tips, and are about one-fourth of the length of the body, which has a slight rim on each side of the back : the legs are moderately long ; the knees, the feet, and the tips of the shanks are brown. The young ones are as usual narrow, flat, and linear, and have short white limbs.

In 1846, a year remarkable for the mildness of the winter and of the spring, it had attained its full size before the end of January, and was very abundant near London beneath the leaves of the spruce-firs, some of which were stripped of their foliage in consequence of its attacks. It does not disappear before the latter part of November.

The viviparous winged female. This form comprises the second generation, and in 1846 its wings were unfolded before the end

of March. It is green: the disc of the chest and that of the breast, the feelers, the tip of the mouth, the tips of the nectaries, the knees, the feet, and the tips of the shanks are brown: the feelers are more than half the length of the body; the fourth joint is very much shorter than the third; the fifth is a little shorter than the fourth; the sixth is shorter than the fifth; the seventh is a little longer than the sixth; and the nectaries are about one-sixth of the length of the body: the wings are colourless and about twice the length of the body: the wing-ribs and the brands are green, and the veins are pale brown; the first and the second veins diverge much from each other, but the second and the third veins are nearly parallel; the latter has its first fork after one-third and its second fork a little before two-thirds of its length; it is more or less obsolete at the base; the fourth vein is much curved, and the angle of the brand whence it springs is hardly perceptible.

Variations of the wing-veins.—1st var. The lower branch of the first fork of the third vein is wanting.

Length of the body $\frac{3}{4}$ line; of the wings $2\frac{1}{4}$ lines.

64. *Aphis Rosarum*, Kalt.

Aphis Rosarum, Kalt. Mon. Pfl. i. 101. 76.

This species feeds on *Rosa centifolia* and *gallica* in gardens, and Mr. Hardy has forwarded to me specimens found on *Rosa spinosissima* in October near Newcastle.

The viviparous wingless female. This little species appears on the rose (*Rosa centifolia* and *gallica*) in the beginning of March or later, and is then dull green, paler beneath, rather flat, and very long: the feelers are rather more than one-fourth, and the nectaries are about one-seventh of the length of the body: the eyes are brown: the legs are short and stout. During its growth it acquires a brighter green hue, and then the limbs are almost white: the front of the head is very convex in the middle: the first joint of the feelers has a slight protuberance on the inner side of its tip; the fourth joint is shorter than the third, but longer than the fifth; the sixth is a little shorter than the fifth; the seventh is much longer than the sixth. It much resembles *A. Caprea*.

1st var. Whitish green, with two vivid green stripes along the back.

2nd var. Whitish green, with two bluish green stripes along the back.

The viviparous winged female. Is black: the fore-chest is green, having in front a blackish green band which is sometimes broad and sometimes narrow: the abdomen is green; each segment is traversed by a black band and has a black spot on each side: the

feelers are black, rather thick at the base, and about half the length of the body : the fourth joint is about half the length of the third ; the fifth is shorter than the fourth ; the sixth is much shorter than the fifth, but more than half its length ; the seventh is as long as the fourth : the mouth and the nectaries are black, and the latter are about one-eighth of the length of the body : the thighs and the shanks, especially of the fore-legs, are dull pale yellow towards the base : the wings are colourless, and much longer than the body ; the wing-ribs are pale yellow ; the brands are pale brown, and the veins are darker ; the second vein diverges from the first, but is nearly parallel to the third, whose first fork is a little after one-third, and its second fork long after two-thirds of its length.

1st var. The thighs and the shanks are yellow with black tips.

2nd var. Black : the abdomen has interrupted gray bands above, and is very dark green beneath : the feelers are nearly as long as the body : the mouth and the nectaries are dark green ; the former has a black tip, and the latter are about one-sixth of the length of the body : the legs are dull buff ; the thighs are pale yellow ; their tips and those of the shanks and the feet are black.

Variations in the wing-veins.—1st var. With no second fork in one wing.

2nd var. The third vein has not two forks, but is divided into three branches.

The oviparous wingless female. Very small, yellow, narrow, long, spindle-shaped, rather flat, and not shining : there are two green stripes along the whole length of the back : the limbs are pale yellow : the feelers have black tips, and are about half the length of the body : the tip of the mouth, the eyes, and the tips of the nectaries are black, and the latter are as long as one-fourth of the body : the legs are moderately long ; the knees, the feet, and the tips of the shanks are black.

The winged male. Appears in September and October, and pairs in the latter month with the oviparous female : it is small and black : the borders of the fore-chest and the fore-breast are pale green : the abdomen is green : the feelers are as long as the body : the mouth is pale yellow with a black tip : the nectaries are dull green with black tips, and as long as one-sixth of the body : the legs are pale yellow ; the feet and the tips of the thighs and of the shanks are black : the wing-ribs and the rib-veins are pale yellow ; the wing-brands and the other veins are pale brown.

1st var. The borders of the fore-chest and the fore-breast are dark green : the abdomen has a row of black spots on each side : the mouth is dull yellow with a black tip : the nectaries are black : the four hinder thighs excepting the base are also black.

Length of the body $\frac{3}{4}$ line ; of the wings 2 lines.

65. *Aphis Avellanæ*, Schrank.

Aphis Avellanæ, Schrank, Faun. Boic. 112. 1207; Kalt. Mon. Pflanz. 143. 116.

This species clusters on the stalks and shoots of *Corylus Avellana*, whereas *A. Coryli* is scattered on the leaves of that tree.

The viviparous wingless female. The body is oval, convex, hairy, pale green, and varies in breadth: the front is bristly, and has a protuberance in the middle, and one more slight at the inner base of each feeler: the feelers are pale yellow and very much longer than the body; the tips of the joints are brown; the first and the second joints are bristly, and the third is also so to a less degree; the fourth joint is a little shorter than the third; the fifth is as long as or longer than the fourth; the sixth is less than half the length of the fifth; the seventh is more than four times the length of the sixth: the mouth reaches the hind hips, or very near thereto, and even much beyond them in the young insects: the nectaries are green, and full one-fourth of the length of the body; they are slightly tapering from the base to the tips: the tip of the abdomen does not form a tube: the legs are pale yellow, very long and hairy; the shanks are very slightly curved; the fore-legs are but little shorter than the hind-legs; the feet and the tips of the shanks are brown: the young ones in the body sometimes amount to twenty or upwards.

1st var. The feelers are a little shorter than the body; the fifth joint is longer than the fourth; the sixth is full half the length of the fifth; the seventh is about one-third of the length of the sixth.

2nd var. The seventh joint of the feelers is about five times the length of the sixth.

3rd var. The body is rose-colour.

4th var. The body is lilac-colour.

The viviparous winged female. While a pupa it resembles the wingless *Aphis* in colour: the rudimentary wings are pale green, and when they are unfolded, the head and the disc of the chest have a darker colour: the wings are colourless, and much longer than the body; the second vein diverges rather more from the first than it does from the third; the forks of the latter are inconstant in length, and sometimes the situation of their source varies in the opposite wings of the same insect; the fourth vein is but slightly curved, and the angle of the brand whence it springs is extremely slight.

Length of the body 1 line; of the wings 3 lines.

[To be continued.]

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

May 9, 1848.—W. Yarrell, Esq., V.P., in the Chair.

The following communications were made to the Meeting :—

1. NOTICE OF A NEW SPECIES OF MONKEY FROM ANGOLA, LIVING IN THE GARDENS OF THE SOCIETY. BY J. E. GRAY, Esq., F.R.S. ETC.

The Society has recently procured a Monkey from Angola, which bears some resemblance to the Diadema Monkey which M. F. Cuvier erroneously described and figured as the female of *Cercopithecus Diana*, but it differs from that species in the lips being black, like the face, and only covered with very short whitish hairs; and also in being much darker coloured; and this blackness has increased since it has been in the possession of the Society and obtained a better fur. At first sight I thought that it might be a melanism of some other species; but on comparing my notes with the specimens in the British Museum collection, I am convinced that it is different from any I have before had the opportunity of examining.

It belongs to the division of the genus *Cercopithecus* with *rounded whiskers formed of annulated hairs, which have no beard, a variegated fur, and black nose and lips*, and is easily distinguished from the species of that division by its dark colour and broad frontal band. I propose to call it

The Pluto. *Cercopithecus Pluto*.

Sp. ch. Black; the hair of the broad frontal band, ringed with white; the large rounded whiskers, the back, the upper part of the front of the sides, and the base of the tail, ringed with varying greenish white; the distal half of the tail black; the face and lips black, with short, scattered white hairs.

Inhab. Angola.

This species is easily known at first sight by the deep black colour of the back of the head, and limbs, and the broad white frontal band: the large mantle-like patch of minute, white, grised hairs on the back, and the large size of the black and white ringed whiskers, giving the whole animal a very striking appearance.

The tail at this time is not in very good condition, and the end appears to have been destroyed.

2. OBSERVATIONS ON SOME BRAZILIAN BATS, WITH THE DESCRIPTION OF A NEW GENUS. BY J. E. GRAY, Esq., F.R.S. ETC.

Having lately received from Hamburg a collection of Bats from Brazil, containing several species which I have not before seen, I beg to lay some observations on them before the Society.

I may premise that they were all named, on what authority I know not, and referred to described species, but several of them do not agree with the specimens which I have received with the same names before, nor with the original descriptions.

ARCTIBEUS LEUCOMUS, n. sp.

Grey brown, paler beneath; axilla whitish; tuft of hair on the side of the neck, near the shoulders, pure white; hair of back grey brown, with darker tips; the arms, and upper and lower surface of membranes near the sides, hairy; the interfemoral membrane rather wide, hairy above; nose-leaf ovato-lanceolate, longer than broad, with a thick midrib; ears rather large, rounded; tragus oblong, toothed on the outer side.

Inhab. Brazils.

I received this specimen under the name of *Phyllostoma brevicaudatum*, but it cannot be of that species, as it has no appearance of any tail. It agrees with P. Neuwied's figure in having a rather wider interfemoral membrane than the other *Arctibei*, but it differs from it in the membranes being much more hairy, and in the absence of the peculiar white, epaulet-like spots.

Length of tarsus $7\frac{3}{4}$ ''; foot 5''; wing-bone 1'' 5''; thumb 6''.

NYCTIPLANUS, n. g.

Tail none; interfemoral membrane none; head short; nose-leaf lanceolate, erect; lower lip entire, with a triangular group of warts in front; cutting teeth $\frac{2}{4}$; ears lateral, separate; tragus denticulated; wings broad; index finger one-jointed, middle finger four-jointed; thumb elongate, lower joint short, inclosed, upper joint elongated, slender, free; feet moderate, toes equal, compressed.

This genus has the same kind of nose-leaf as *Phyllostoma*, but differs from all the genera with that form of nose-leaf in having no interfemoral membrane. In this character it agrees with *Diphylla* and *Stenodema*; but these genera only have a scarcely elevated nose-leaf.

NYCTIPLANUS ROTUNDATUS, n. sp.

Dark brown, beneath paler; hair yellowish brown, with dark tips; of the under side paler, with pale tips; of the sides of the body dark blackish brown; the fore-arm above and below, and the upper part of the wing-membranes near the body and on the side of the legs hairy; nose-leaf ovate, lanceolate, about as long as broad; apex acuminate; ears rather acute, naked; tragal lanceolate, acute.

Inhab. Brazils.

Length of wing-bone 1'' $7\frac{1}{2}$ ''; tarsus $8\frac{1}{2}$ ''; foot 5''; thumb 5''.

I received this specimen under the name of *Phyllostoma rotundatum*, which is probably the MS. name of some German zoologist.

3. DESCRIPTION OF A NEW HERON. BY JOHN GOULD, ESQ., F.R.S. ETC. ETC.

ARDEA LEUCOPHÆA, n. sp.

Forehead and upper portion of the crest white; sides of the head and lower portion of the crest deep glossy black; neck white, washed with vinous, and with a series of lanceolate marks of black disposed alternately down the front; all the upper surface, wings and tail dark grey, the lanceolate feathers of the back fading into white; edge of

the wings buffy white; primaries and secondaries dark slate-colour; flanks and under surface of the wing grey; chest and abdomen white, separated from the grey of the flanks by a series of black feathers; under tail-coverts and thighs white; bill yellow; tarsi olive.

The young differs in having the whole of the crown of the head black; all the upper surface greyish brown; and the under surface striated with brown and white.

Total length 38 inches; bill 7; wing 19; tail $7\frac{1}{2}$; tarsi 5.

Hab. India and Australia.

Remark.—Having carefully compared examples of this species with the Common Heron of Europe, I find it differs from that bird in being altogether of a larger size, and that the line of the bill, instead of being straight, has an upward tendency; in other respects they are very similar.

4. ON THE HABITS OF *MABOUYA AGILIS*. BY P. H. GOSSE.

In the parts of Jamaica with which I am familiar, this pretty, active little Scink is abundant. It is most numerous in the lowlands, and on the gently-sloping hills of moderate elevation that form the characteristic feature of the southern side of that beautiful island. The fences there are largely composed of 'dry-wall,' built of rough unhewn stones, without cement. On these walls the *Mabouya* may be seen crawling, and often lying quite still in the sunshine; when alarmed it darts with lightning-like rapidity into one of the crevices which abound in all parts of such a structure. Indeed it rarely ventures far from some refuge of this kind, and I presume that the facilities for instant retreat afforded by these pervious walls are the chief cause of its preference for them. It is scarcely ever seen on the ground, except when avoiding danger; nor on the trunk or branches of trees or shrubs; but in the concavity of a pinguin leaf (*Bromelia pinguin*) it is occasionally observed to lie, basking in the sun.

The rounded form of the head and body, devoid of projections; the close-lying and glossy scales; the shortness of the legs, bringing the belly flat upon the ground; and its constant habit of resting with the chin on the ground also, give to the *Mabouya* an aspect very much unlike that of our other common lizards, and cannot fail to remind even the least observant of its affinity with the serpent-tribes. The negroes, in the recognition of this proximity, doubtless, have bestowed upon it the appellation of "Snake's waiting-boy," or more briefly, "Snake-boy." In the parishes of St. Elizabeth's and Westmoreland it is also frequently called the "Woodslave," though in other parts of the island this term seems to be applied to some of the *Geckotidæ*. From the shortness of its legs results also another resemblance to a snake, for owing to the shortness of the steps, if made only with the legs, it throws the shoulder and the hip forward at each step; and this throwing-out of the sides at different parts alternately produces a wriggling motion, somewhat serpentine in appearance.

The Woodslave is not very easily captured alive: the hair-noose so successfully used in taking our other small lizards I have always

found to fail, if tried on this species; for though it is not difficult to pass the noose over the head (the reptile allowing this so long as its assailant's approaches and motions are deliberate and gentle), it is instantly slipped off again, because there is no sensible contraction behind the occiput, and the scales lie too smoothly to afford the slightest hold. They are too wary and too swift to be caught by the hand. A smart tap with a switch, however, across the shoulders or the back disables them for awhile; but if the blow descend on the tail, that organ instantly separates, with the like brittleness, as in other lizards. Cats not unfrequently catch them.

The form of the scales and the manner of their apposition remind us of the fishes: they are convex above, concave beneath, are slightly attached to the skin, and lap over each other at the edges. The colours of the animal are produced by pigment deposited on the under surface of the scales, which in a scale recently removed is soft, and readily rubbed off: the skin beneath is black. The scales, which are subpentagonal, are marked with a series of regular lines, indented on both surfaces, connected by transverse ones, somewhat like the nervures in the wing of an insect; they lose themselves before they reach the hinder edge. The pigment is deposited in the centres of the areas formed by the lines. The scales from the back and from the belly are alike; but the postreme two-thirds of the tail are covered, both on the upper and under surfaces, by narrow transverse plates, which do not essentially differ however from the other scales, except in having a greater number of parallel depressed lines.



A scale, magnified.

The beautiful provision for protecting the eye without impeding vision, shown by the lower (and larger) eyelid having a sort of window, a transparent, glassy, circular plate in its centre, immediately opposite the pupil when the eye is closed, is well-worthy of admiration as an obvious example of creative wisdom and providential care. Habitually darting to and fro in the narrow crevices of walls and heaps of stones, the eyes of the Woodslave, if unprotected, might be continually liable to injurious contusions, while as it feeds on the insects, at least in part, that resort to such situations, undimmed vision would be essential to it while permeating them.

The Woodslave is viviparous. I first became aware of this fact by the dissection of a specimen killed on the 11th of February, in the abdomen of which were several oval sacs, about half an inch long, composed of a soft, transparent, very tender membrane, which displayed a fœtus within each, far advanced to maturity. And on the 29th of April I killed another female, the abdomen of which was very much dilated: in this specimen I found four young, quite matured, and fully coloured, with a brilliancy indeed superior to that of the adult: they were enveloped in two sacs, but each fœtus was inclosed in its own amnios besides, a very delicate membrane in which it lay coiled up; the vitellus not quite absorbed, but attached by the funis to the belly. There was also a portion of the tail of a fifth fœtus, the body of which had probably been forced from the abdomen of the

parent, through the wound which killed it. The young measured, from the muzzle to anus, $1\frac{4}{10}$ inch; thence to extremity of tail $1\frac{9}{10}$ inch. These two specimens, displaying the contents of the abdomen *in situ*, are now, with other specimens of both sexes, in the British Museum.

I afterwards found that this fact had not escaped the observation of the indefatigable Robinson; for, on consulting his manuscript volumes in Kingston, I met with the following notes, recorded nearly a century ago:—"No author that I have met with has observed that any animals of the Lizard-kind are viviparous; yet I have by accident discovered that the smooth Snake-lizard of Jamaica brings its young forth alive. Mr. Long having caught one of these alive, tied it all night upon a table with a thread, and in the morning found a young one or two lying near the other, which was a full-grown one. Being at a loss to account for this, as imagining that all the Lizard-kind were oviparous, he called upon me to know my sentiments. It appeared very plain to me that this animal was viviparous; nor does this seem strange to me, when I consider that some of the Serpent-kind are also viviparous, viz. the Viper and Rattle-snake.

"Some time in August 1760, as I was looking over a parcel of preserved lizards, finding amongst the rest one of these Snake-lizards full-grown, with the belly very much distended, in which state they may be often seen,—I took my penknife, and endeavoured to cut the abdomen open, but found it so well defended by a covering of very small hard scales, like those of a fish, that my knife would not enter till I had scraped them away, when opening the abdomen I found two beautiful young ones, about two inches long." (Rob. MSS. iv. 47.)

The stomach is a lengthened sac. In specimens that I examined I found small cockroaches, fragments of crickets, &c., insects which live in heaps of stones. In one specimen I observed a few slender, rather short, intestinal thread-worms, loose among the abdominal viscera.

Sloane's '*Lacerta minor lævis*' (tab. 273. fig. 5) is certainly the present species, and is not a bad representation. His description, however, like most of his zoological notes, is full of confusion and error. He says, "This is bigger than the former [which I think to be the female of the Purple-tailed Anolis*], smooth, having a great many brown spots, otherwise much the same [!], laying a very small, white, hard-shelled egg (fig. 6) [which is however the egg of a common little *Spheriodactylus*], nestling in rotten-holed trees [here he confounds it with *Gecko rapicauda*], leaping from one bough to another [here with the *Anoles*]; 'tis very common among old palisades, &c." It is very evident to me that Sloane's zoological notes were but in a slight degree the result of his own observation; he trusted to the loose reports of negroes and others, generally correct of something or other, but very often misapplied, the local names and habits of widely different species being huddled and mingled together in almost inextricable confusion. That fruitful source of error, the application of the same names to different species in different (and

* I hope to describe this species in a future memoir.—P. H. G.

sometimes in the same) localities, to which I have alluded in my 'Birds of Jamaica,' p. 177, against which a naturalist should always be on his guard in a foreign country, appears to have misled our venerable naturalist. Nor does it seem to me disrespectful to the name of that great man thus to expose his mistakes, since I feel able to speak positively, from long-continued and familiar personal observation, and because precision in the narration and application of facts is of the highest importance in natural science.

I subjoin a description, noted from the living animal. Head, neck and fore-part of back, reddish brown, bronzed; a broad band of black runs from the muzzle on each side, inclosing the eye, and passing down to the hind-leg; this band is bounded, both above and below, by a band of yellowish white, gradually becoming obsolete between the fore- and hind-leg; each of these pale bands is again bounded by a line of black, more or less interrupted or maculate, the superior of which extends along the tail; lower back and tail, greenish brown; whole under-parts greenish white, silvery; upper surface of the limbs and feet black, with pale confluent spots. The whole animal reflects a metallic gloss. There is no appreciable difference in the sexes.

Dimensions of one measured, a gravid female, of rather large size:—Length, muzzle to anus $3\frac{7}{10}$ inches; tail $5\frac{1}{4}$; total nearly 9 inches. Muzzle to eye $\frac{5}{20}$ in.; muzzle to ear $\frac{7}{20}$ in.; muzzle to front of fore-leg $1\frac{2}{10}$ in.; axilla of fore-leg to front of hind-leg 2 in.; fore-leg, from axilla to tip of claws, $\frac{9}{10}$ in.; hind-leg $1\frac{3}{10}$ in.

This is the only species of *Mabouya* that I found in Jamaica. Is *M. Sloanei* (Dum. et Bib.), which is ascribed to the same island, really distinct?

June 13.—Harpur Gamble, Esq., M.D., in the Chair.

1. DESCRIPTION OF *TRAGELAPHUS ANGASII*, GRAY, WITH SOME ACCOUNT OF ITS HABITS. BY GEORGE FRENCH ANGAS.

This new and brilliant Antelope, the *Inyala* of the *Amazulu*, appears to be a link between the Koodoo and Boshbok, uniting in itself the markings and characteristic features of both these animals.

The adult male is about 7 ft. 6 in. in total length, and 3 ft. 4 in. high at the shoulder. Though elegant in form, and with much of the grace of the solitary Koodoo, the robust and shaggy aspect of the male bears considerable resemblance to that of the Goat. Legs clean; hoofs pointed and black, with two oval cream-coloured spots in front of each fetlock, immediately above the hoof. Horns 1 ft. 10 in. long, twisted and sublyrate, very similar to those of the Boshbok, but rather more spiral; have sharp polished extremities, of a pale straw-colour; rest of horns brownish black, deeply ridged from the forehead to about half the length of the horn. Prevailing colour greyish black, tinged with purplish brown and ochre; on the neck, flanks, and cheeks, marked with several white stripes like the Koodoo; forehead brilliant sienna-brown, almost approaching to orange; mane black down the neck, and white from the withers to the insertion of the tail. Ears 8 in. long, oval, rufous, tipped with black and fringed inside with white hairs; a pale ochreous circle

round the eyes, which are connected by two white spots forming an arrow-shaped mark on a black ground; nose black; a white spot on each side of the upper lip; chin and gullet white; and three white marks under each eye; neck covered with long shaggy hair, extending also under the belly and fringing the haunches to the knees; two white spots on the flanks, and a patch of long white hair on the anterior portion of the thigh; a white tuft under the belly, and another on the dewlap; on the outer side of the fore-legs is a black patch above the knee surrounded by three white spots; legs below the knee bright rufous colour; tail 1 ft. 8 in. long, black above, with tip and inside white.

Female smaller and without horns; total length 6 ft.; nose to insertion of ear 10 in.; length of ear $6\frac{1}{2}$ in.; height from fore-foot to shoulder 2 ft. 9 in.; tail 1 ft. 3 in. in length. Colour a bright rufous, inclining to orange, becoming very pale on the belly and lower parts, and white inside the thighs; a black dorsal ridge of bristly hair extends from the back of the crown to the tail; nose black; the white spots on various parts of the body nearly resemble those of the male, only the white stripes on both sides are more numerous and clearly defined, amounting to twelve or thirteen in number; tail rufous above and white below, tipped with black.

The young resembles the female, but is rather paler in colour, and has more white spots on the flank and sides.

Inhabits the lower undulating hills scattered with Mimosa bushes, that border upon the northern shores of St. Lucia Bay, in the Zulu country, lat. 28° south. Found in small troops of eight or ten together, feeding amongst the thickets.

Mr. Gray has named this species after my father, George Fife Angas, Esq., of South Australia, who has always taken a lively interest in my travels and researches in natural history. I may add, that the preceding notes were drawn up from recently-killed specimens, which I in vain attempted to purchase from the Boers who possessed them.

2. DESCRIPTION OF A NEW SPECIES OF *PODICA*.

By G. R. GRAY, Esq., F.L.S. ETC.

The bird now laid before the Meeting forms a second species of the genus *Podica*, Less., the type of which, *P. senegalensis*, is peculiar to Western Africa. It was obtained from Malacca, and thus extends the range of this singular group, *Heliorninae*, to a third quarter of the globe. The only species known until of late years, which is the type of the subfamily (*Heliornis surinamensis*), exists in the warmer parts of the American continent.

PODICA PERSONATA, n. sp.

Sp. ch.—Upper parts olive-brown; top of the head, lores, cheeks and jugulum, deep black; back of neck bluish olive; a short white streak borders the black from the posterior angle of the eye; the lower surface white; breast tinged with brown; the side-feathers faintly, and the under tail-coverts deeply, barred with brown; the

quills and tail deep brown; bill yellow; the feet lead-colour, and the membrane that borders the toes yellow.

Total length, 20 inches; bill, 2 inches and 2 lines; wing, 10 inches; tarsi, 1 inch and 10 lines.

It differs from the typical *Podica* in having a portion of the lores naked, in the greater breadth of the tail-feathers, and in their being rather rigid.

The only specimen I have seen, from which this description and the drawing have been made, was presented to the British Museum by the Right Hon. the Earl of Ellenborough.

MISCELLANEOUS.

On Polycotyledonous Embryos. By M. P. DUCHARTRE.

SINCE Jussieu, by a happy application of a principle first asserted by Ray, has taken the characters furnished by the embryo for the basis of the great divisions of the vegetable kingdom, all the questions relating thereto have become highly important. The first of these characters is that deduced from the number of the cotyledons, according to which all embryonal plants have been divided into monocotyledons and dicotyledons. This number is nearly always, in fact, one or two; but according to the majority of botanists, it exceeds two in the embryo of a small number of plants to which the denomination of polycotyledonous has been applied. By a remarkable peculiarity these plants are distributed among several families and also genera of which the majority of species have the more frequently but two cotyledons; whence it has been considered impossible to establish for them a special class. The object of this memoir is to examine if these plants are really provided with several distinct cotyledons, or have only two which are deeply divided into a variable number of lobes.

I first show by several examples that the cotyledons, or the seminal leaves of the dicotyledonous plants, have a very marked tendency to divide on their median line, in various degrees, sometimes so deeply as to cause each cotyledonous lobe to be wrongly considered as constituting a distinct cotyledon. Amongst other facts, I have described and figured germinating plants of *Dianthus chinensis*, Linn., which show all the degrees of division from the slit of one of the seminal leaves to the complete division of each one of the two into two nearly independent lobes. I also show by a series of different states, that the embryo of the *Macleya* owes to a division of its cotyledons the remarkable appearance which has caused it to be described as possessing sometimes from three to four cotyledons. I nevertheless observe that, in some very rare cases, the binary whorl of cotyledons may become ternary; of which examples are enumerated.

I then pass to those embryos the cotyledons of which are normally bipartite, and describe the development of that of *Amsinkia* and their germination. I show that the two cotyledons of these plants, sim-

ple at their first appearance, each very soon develope two equal lobes ; and that, from this moment until when the two seminal leaves have attained their complete development, it becomes more and more evident that each of them is only divided in the direction of the medial line.

A complete analogy of development and organization induced me then to study the embryo of *Schizopetalon Walkeri*, Sims., to which Mr. Robert Brown, in the 'Botanical Register,' tab. 752, and recently M. Barnéoud, have assigned four distinct and separate cotyledons, contrary to the opinion expressed by Mr. W. Hooker in the 'Exotic Flora,' tab. 74. I show that the embryo of this plant passes through a series of analogous states to those which I have mentioned in *Am-sinkia* ; that its germination resembles that of the latter plant, although the division of each of its two seminal leaves into two lobes is still deeper ; lastly, I adduce in support of these facts those which the anatomical structure furnishes, and I show that in the germinations of *Schizopetalon* we find two fibro-vascular bundles which correspond to the undivided portion of the two cotyledons, and which, higher up, separate into two branches, each destined for one of the two cotyledonary lobes. This singular genus of Cruciferae should consequently be removed from the list of polycotyledonous plants.

After having taken a glance at the species of *Canarium* and *Agathophyllum*, the embryo of which appears to have but two cotyledons, each divided into three or more lobes, I come to those Coniferae that have been considered to possess several cotyledons, and in which it is generally agreed the type of the polycotyledonous embryos is found. This opinion was admitted in science on the authority of Gärtner, Salisbury, L. C. Richard, and M. A. Richard. It is entirely opposed to that expressed by Adanson and Jussieu, who state that these Coniferae have but two cotyledons deeply divided into a considerable number of long narrow lobes. Although this latter view has been abandoned by modern botanists, I have attempted to prove that it alone is based on facts. After having discussed the objections which have been raised against it by Gärtner and M. A. Richard, I deduce from a careful examination of the embryo in seventeen different species, and of that of the germination in some of them, the following results.

The pretended multiple cotyledons of the Firs, and of the genera in which the embryo is organized on the same plan, are not verticillate, that is to say, arranged regularly in a circle around a point. On the contrary, they always occur divided into two opposite groups, absolutely placed like two ordinary cotyledons. In each of these two groups, the appendages which have been regarded as distinct and separate cotyledons, and which I regard only as lobes, are generally pressed one against the other, whilst a very marked space exists between the two groups, sometimes large enough to occupy, towards the centre, about a third of the total diameter of the embryo. Often, and particularly in the case where the lobes are numerous, the embryo is compressed in the direction of the breadth of the two cotyledons. Viewing the embryo from the top, the pretended mul-

tiple cotyledons are frequently seen ranged in two parallel lines, and these two lines are then separated one from the other by a very visible slit. This intercotyledonary slit is continued to the two opposite sides of the embryo, where it is easily recognised by its greater size, especially in some species (*Pinus pinaster*, Solan., *Pinus excelsa*, Wall., &c.). In certain cases these two opposite lateral slits gradually descend lower than those interposed between the lobes; the assertion of Jussieu therefore, although too much generalized, was based on facts. To recognise, in these doubtful cases, the arrangement of the cotyledonary lobes into two groups, the best plan is to make with a very sharp instrument, a transverse section towards the middle of the lowest cotyledons; the remaining basilar portion evidencing clearly, in almost every case, the arrangement here described.

To these facts furnished by the adult embryo, I add others taken from the germination and phyllotaxy. M. Lestiboudois has likewise recently been led, by observations on anatomical phyllotaxy, to admit that all the Coniferæ are dicotyledonous.

The species of *Ceratophyllum* have been and are still described as possessing four unequal cotyledons in pairs. But the observations of M. Schleiden, with which mine agree on nearly every point, have sufficiently shown that it is an error arising from the first whorl of plumular leaves, and which always appear binary, having been confounded with the two cotyledons.

After having removed from the category of polycotyledonous plants nearly all those admitted as such, there remains in my opinion but some species of *Persoonia* which should provisionally be referred to this group, upon the authority of Mr. R. Brown, and respecting which I am unable to form an opinion owing to want of material.—*Comptes Rendus*, xxvii. p. 226.

Preparation of Pineapple Fibres in Singapore for the Manufacture of Pina Cloth.

Some time ago we observed, in the neighbourhood of Batu Blyer, a number of Chinese labourers employed in cleaning the fibres of pineapple leaves for exportation to China. As we believe this to be a new and promising branch of industry in this settlement, where numerous islets are covered by the pineapple, it would be well to draw the attention of the Chinese and Bugis frequenting or inhabiting these islets to the subject. The process of extracting and bleaching the fibres is exceedingly simple. The first step is to remove the fleshy or succulent side of the leaf. A Chinese, astride on a narrow stool, extends on it, in front of him, a pineapple leaf, one end of which is kept firm by being placed beneath a small bundle of cloth on which he sits. He then with a kind of two-handled plane made of bamboo removes the succulent matter. Another man receives the leaves as they are planed, and with his thumb-nail loosens and gathers the fibres about the middle of the leaf, which enables him by one effort to detach the whole of them from the outer skin. The fibres are next steeped in water for some time, after

which they are washed in order to free them from the matter that still adheres and binds them together. They are now laid out to dry and bleach on rude frames of split bamboo. The process of steeping, washing, and exposing to the sun is repeated for some days until the fibres are considered to be properly bleached. Without further preparation they are sent into town for exportation to China.

Nearly all the islands near Singapore are more or less planted with pineapples, which at a rough estimate cover an extent of two thousand acres. The enormous quantity of leaves that are annually suffered to putrefy on the ground would supply fibre for a large manufactory of valuable pina cloth. The fibre should be cleaned on the spot. Fortunately the pineapple planters are not Malays, but industrious and thrifty Bugis, most of whom have families. These men could be readily induced to prepare the fibres. Let any merchant offer an adequate price, and a steady annual supply will soon be obtained.—*From the Journal of the Indian Archipelago and Eastern Asia*, No. 8, Aug. 1848.

Advantages accruing from the Study of Entomology.

To estimate in their true extent the important bearings of Entomology on our pecuniary interests, we must not confine our attention to the hundreds of thousands of pounds which we annually lose from the attacks of the hop-fly, the turnip-flea, the wire-worm, the weevil, and the host of insect-assailants of our home agricultural and horticultural produce, but we must extend our views to our colonies, and we shall there find that in Australia the potato crops (as we learn from Mr. Thwaites) are in some quarters wholly cut off by the potato-bug; that in the West Indies, in addition to the numerous and long-known insect-enemies of the sugar-cane, a new pest of the *Coccus*-tribe, sent us by Dr. Davy, has lately attacked it in Barbados, and the cocoa-nut trees in the same island have nearly fallen a sacrifice to a minute *Aleyrodes* referred to by Sir Robert Schomburgk; while in India the cotton crops are often seriously injured by insects of various tribes, whose history we have yet to learn; and in Ceylon, the Governor, Lord Torrington, states, in a letter addressed last year to Earl Grey, so serious have the attacks of the "Coffee-bug" (a species of *Coccus* or scale-insect, said to be allied to *C. Adonidum*) proved for the last few years to the coffee-plantations, that the produce of one estate, which had in former years been 2000 cwt. of coffee, fell suddenly to 700 cwt. wholly from the destruction caused by the bug; and a similar heavy loss as to other coffee-plantations is confirmed by Mr. Gardner, who speaks of the insect as not confining its ravages to these, but spreading to other trees and plants, as limes, guavas, myrtles, roses, &c., so that in the Ceylon Botanic Garden there is scarcely a tree not in some measure affected.

It appears highly probable, from facts collected by Mr. Gardner, and quoted in the 'Gardener's Chronicle' of Oct. 7, 1848, p. 667, that this coffee-bug was introduced into Ceylon with some Mocha coffee-plants brought from Bombay; and it is equally probable, as

Dr. Lindley suggests, that had the foul plants been all burnt, or dipped in hot water, so as to kill the bugs, the Ceylon coffee-planters might have been saved from their present painful position. But why were not these precautions taken? Simply because these coffee-planters are wholly ignorant of entomology. When Kalm, the Swedish naturalist, descried specimens of *Bruchus Pisi* disclosed in a parcel of peas he had brought from North America, he was thrown into a state of trepidation lest some of these pestilent insects should have escaped, and he should have been thus the unconscious instrument of introducing so great a calamity into his beloved country. And had the Ceylon coffee-planter, to whom these infected Mocha-plants came, possessed a far less amount of entomological knowledge than Kalm, he would have carefully examined them, aware how easily a new insect-pest may be introduced from a foreign country, and of what vital importance it is that it should be ascertained that such introduced plants are free from disease, or thoroughly cleansed from it, if present.

Here we have a further striking instance how desirable it is, as I have before contended, that some instruction in Natural History, and in Entomology as a branch of it, should be universally given in all our schools, from the highest to the lowest. Not only may a landed proprietor at home suggest to his tenants, or a country clergyman to his flock, the best way of destroying their insect-enemies; but if our middle classes, likely to become in the course of their emigrations to our colonies, now every year more extensive, coffee-planters in Ceylon, or cotton-growers in India, or general agriculturists in Canada, Australia, or the Cape, were taught something at school of the history of these assailants, as well as the working-men who accompany or assist them, there can be no doubt that this branch of their school education would turn to far more pecuniary advantage than much of what is now taught them.

In adverting to this subject in my last year's Address, I pointed out how little merely "practical" but unscientific men are qualified to cope with the insect-hosts that assail them on every side, and I quoted the remarkable instance, which cannot be too often repeated, of the 240,000*l.* a-year which M. Guérin-Méneville, the distinguished French entomologist, has saved the olive-growers of the south of France by teaching them a mode, founded on the economy of the olive-fly (*Dacus Oleæ*), of neutralizing the attacks of this pest, of which, in spite of all their practical skill, they were the annual victims to this large amount. I will conclude these remarks with referring to the prospect we now have of seeing our hop-plantations freed from their great destroyer the hop-fly (*Aphis Humuli*)—not from the efforts of the hop-growers, who considering it "a blight" brought by some cold wind or atmospheric change, fold their arms in helpless apathy; but in consequence of the investigations into the history and economy of the insect by an eminent British entomologist, Mr. Francis Walker*, who has attended very closely to this

* Annals of Nat. Hist. 1848, vol. i. p. 373.

tribe. The difficulty in the case of the hop-aphis has always been to know where the eggs from which the flies proceed in spring, are placed by the gravid females in autumn. This could not be on the hop-plant, which dies down yearly to the roots. But the mystery has been solved by Mr. Walker, who has found that it is on the *sloe-tree* or *black-thorn* (*Prunus spinosa*) that the female deposits her eggs in autumn, which are there hatched in spring, and the second generation being produced with wings, flies to the hop-plants and establishes itself on the leaves, which, owing to the well-known rapid increase of these insects, it soon covers and exhausts of the sap. Now if the hop-aphis does not deposit its eggs on any other shrub or plant than the sloe, as Mr. Walker believes, it is evident that, to secure the hops in any district from the hop-aphis, it is only necessary to destroy all the sloe-trees, which, as they are found chiefly in hedges, and there in no great number, would be no difficult matter. And if, from the escape of a part of the sloe-trees, and the flight of some of the hop-aphides from distant quarters, a few of the female aphides were still found on the hop-plants in spring, nothing would be easier, as I ascertained by experiments in hop-grounds in Worcestershire in 1838*, than to clear them from every one of these assailants, at a very trifling expense, by employing women and children, by means of step-ladders, to crush every aphis found, by pressing them and the leaf between the thumb and fore-finger, so as to destroy the flies without injuring the texture of the leaf. When it is considered that the extirpation of the hop-aphis would in some years save 200,000*l.* to the revenue, and three or four times as much to the hop-growers, it is evident that this is a matter worth attention, and that the science which can effect this saving is no trifling one.—*From the Address delivered by the President W. Spence, Esq., F.R.S., at the Anniversary Meeting of the Entomological Society of London, Jan. 22, 1849.*

Description of a new Mexican Quail. By WILLIAM GAMBEL. M.D.

Ortyx thoracicus. With a full, somewhat pointed crest, the feathers of which are black, obscurely mixed with dull brown and rufous. Nape mottled with black and bright rufous, and traversed by two interrupted white lines, which commence of a cinereous colour about the front and pass over the eyes. Throat and cheeks pale cinereous, each feather with a narrow black margin. Sides of neck, breast and sides pale rufous; deepest on sides of neck, where the feathers have a few scattered black spots. Lower part of belly and vent white. Under tail-coverts rusty white, mottled with black. Tail very short and rounded, its colour dark brown, with freckled irregular bars of rusty white. Lower part of back and upper tail-coverts irregularly variegated with different shades of gray, fulvous and black; upper part of back dark rufous, the centres of the feathers grayish, and traversed by fine, irregular, dusky lineations. Wings and scapulars beautifully variegated with black, rufous and gray;

* Introd. to Entomology, 6th edit., vol. i. p. 149.

wing-coverts and scapulars having the upper vanes deep black, margined and lined with rufous, the lower vanes grayish freckled, and blotched with black, while the shafts are dull whitish.

Tertiaries on their upper vanes with broad fulvous margins; feet and legs pale; bill black; irides chocolate-brown.

Length 8 inches, wing 5 inches, tail 2 inches, tarsus $1\frac{3}{10}$ ths, ridge of bill $\frac{6}{10}$ ths, from angle of mouth $\frac{7\frac{1}{2}}{10}$ ths.

This appears to be an undescribed species of that group of quails which so much resemble our common *O. virginianus*. The present however is readily distinguished from that species by its much longer bill and very short tail, as well as its general markings, particularly beneath; the breast and sides being of a plain fawn-colour, or pale rufous. The only specimen from which I describe was brought from Jalapa, Mexico, by Mr. Pease. It does not appear to be quite adult, and the markings about the head and throat may be somewhat different in the old bird; still however its characters are sufficiently marked. Judging from description, it must very nearly resemble the *O. pectoralis* of Gould; but besides the difference of markings, he makes no mention of that species having a crest. The length of the bird, as well as of the wing, is in this also just one inch greater, which would hardly be the case in a young bird.—*Proceedings of the Academy of Natural Sciences of Philadelphia*, vol. iv. p. 77.

Descriptions of two new Californian Quadrupeds.

By WILLIAM GAMBEL, M.D.

Dipodomys agilis. Colour above yellowish brown, mixed with dusky; beneath pure white, extending half-way up the sides. Head elongated, tapering from the ears to a sharp point. Ears nearly round, sparsely hairy. Eyes large, dark brown. A large pouch on each side of the head, opening externally on the cheeks. Both hind- and fore-feet with four toes and the rudiment of a fifth. The hind-legs very long and strong. Tail very long, slender, covered with hair, and ending in a pencillated tuft.

Length $10\frac{1}{2}$ inches, including the tail, which is $6\frac{1}{2}$ inches.

Dental system:	Teeth	{	10 upper.	{ 2 incisors.
			20.	{ 8 molars.
			10 lower.	{ 2 incisors.
				{ 8 molars.

In the upper jaw the incisors are divided by a longitudinal furrow.

This beautiful Jerboa-like animal is an abundant inhabitant of the vineyards and cultivated fields of the Pueblo de los Angeles, Upper California.

Like the other pouched animals, it forms extensive burrows, traversing the fields in different directions, and is only dislodged during the process of irrigation. They leap with surprising agility, sometimes the distance of ten feet or more at a spring, and are difficult to capture.

Mus californicus. Dark gray, lighter about the head and shoulders, above tinged with light brown, on the sides almost fulvous,

beneath almost white. Fore-feet with four toes and the rudiment of a fifth. Hind-feet with five toes. Tail nearly 5 inches in length, pretty thickly covered with short rigid hairs. Head acutely conical; ears large, rounded, thin, sparsely hairy, 1 inch in length and $\frac{5}{8}$ ths in breadth. Length of the body $4\frac{3}{4}$ inches. Old male: bristles of the nose $2\frac{1}{2}$ inches.

I captured but a single specimen of this species in a field near Monterey, Upper California, which, with those of the former, I had the misfortune to lose.—*Ibid.*

METEOROLOGICAL OBSERVATIONS FOR FEB. 1849.

Chiswick.—February 1. Frosty: foggy: rain. 2. Drizzly: hazy: rain. 3. Hazy and damp: densely overcast. 4. Overcast. 5. Very fine: overcast. 6. Hazy: densely overcast. 7. Overcast. 8. Very fine: clear. 9. Fine: overcast. 10. Overcast: clear at night. 11. Clear: very fine: barometer unusually high: clear and frosty at night. 12. Frosty and foggy: fine: clear and frosty. 13. Dense fog: fine at noon: foggy. 14. Foggy: fine. 15. Very fine. 16. Foggy: clear at night. 17. Frosty: exceedingly fine. 18. Overcast. 19. Overcast: fine. 20. Slightly overcast: cloudy: rain. 21. Cloudy and fine: rain. 22, 23. Fine. 24. Drizzly: rain: lightning in the evening: densely overcast. 25. Hazy: boisterous, with rain and thunder: constant heavy rain at night. 26. Cloudy and fine: frosty. 27. Frosty: cloudy and fine: clear. 28. Boisterous, with heavy rain.—On the 11th the barometer was higher than it has ever been observed in this locality.

Mean temperature of the month	41°·35
Mean temperature of Feb. 1848	43 °06
Mean temperature of Feb. for the last twenty years	40 °36
Average amount of rain in Feb.	1·61 inch.

Boston.—Feb. 1. Fine. 2, 3. Foggy. 4, 5. Fine. 6, 7. Cloudy. 8. Fine: rain P.M. 9—12. Fine. 13. Foggy. 14—17. Fine. 18. Cloudy. 19. Cloudy: rain P.M. 20. Fine: rain P.M. 21. Cloudy. 22, 23. Fine. 24, 25. Cloudy. 26, 27. Fine. 28. Rain: snow A.M. and P.M.

Applegarth Manse, Dumfries-shire.—Feb. 1. Frost and snow: looking moist P.M. 2. Fog and drizzling all day. 3. Fog and drizzling. 4. Dull A.M.: drizzling rain P.M. 5. Still dull, but fair: cloudy and moist P.M. 6. Mild: cloudy: high wind P.M. 7. Rain during night: fair and clear. 8. Fair, but dull A.M.: rain P.M. 9. Fair early A.M.: rain at noon: rain P.M. 10. Fine morning: one shower: clear P.M. 11. Frost: fog: cleared P.M. 12. Fair: slight shower: cleared. 13. Frost A.M.: clear: rain P.M. 14. Fine spring day: dry throughout. 15. Fine: drying wind. 16. Frost: clear and fine: high wind P.M. 17. Fair and clear: storm of wind. 18, 19. Rain and wind. 20. Dull and moist. 21. Frost: rain and wind P.M. 22. Dull A.M.: came on storm, wind and rain. 23. Fair: slight frost: snow on hills. 24. Frost and snow: clear: freezing. 25. Hard frost: fine. 26. Very hard frost: hail-shower. 27. Hard frost. 28. Rain heavy: wind high.

Mean temperature of the month	41°·2
Mean temperature of Feb. 1848	40 °1
Mean temperature of Feb. for the last twenty-five years	37 °3
Rain in Feb. 1848	5·53 inches.
Average amount of rain in Feb. for the last twenty years	2·04 "

Sandwick Manse, Orkney.—Feb. 1. Clear: frost: cloudy. 2. Cloudy. 3. Bright: drizzle. 4. Bright: clear: hoar-frost. 5. Drizzle: rain. 6. Clear: cloudy. 7. Drizzle: cloudy. 8. Bright: hail, thunder and lightning. 9. Cloudy: damp. 10. Thunder and lightning: sleet-showers. 11. Bright: cloudy. 12. Fine: clear: aurora. 13. Showers. 14. Rain. 15. Rain: drizzle. 16. Hazy: showers. 17. Cloudy: showers. 18. Showers. 19. Showers: aurora. 20. Snow-showers. 21. Frost: snow-showers. 22, 23. Snow: frost: aurora. 24. Snow-showers. 25. Snow-showers: clear: frost. 26. Snow-showers: clear: aurora. 27. Snow: fine: clear: aurora. 28. Rain: sleet-showers.

Meteorological Observations made by Mr. Thompson at the Garden of the Horticultural Society at Chiswick, near London; by Mr. Veall, at Boston; by the Rev. W. Dunbar, at Applegarth Manse, Dumfries-shire; and by the Rev. C. Clouston, at Sandwick Manse, Orkney.

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XXXVI.—*On the Excavating Powers of certain Sponges belonging to the genus Cliona; with descriptions of several new Species, and an allied generic form.* By ALBANY HANCOCK, Esq.

[With four Plates.]

WHILE engaged in investigating the method by which the *Mollusca* bury themselves in stone, wood, and other hard substances, I was naturally led to examine the chambers inhabited by *Cliona*; and having arrived at the conclusion that they are not the deserted abode of worms, or cavities accidentally formed by erosion or otherwise as has been stated, but that they are worked out by this curious production itself, I asserted such to be the case in a paper communicated by me to the last Meeting of the British Association. Since then I have gone more fully into this subject, and as the prevailing opinion appears to be adverse to that expressed by myself, I purpose now giving a detailed account of the facts, which I trust will be deemed sufficient to justify my former statement.

My investigations have led to the discovery that *Cliona celata* does not stand alone as an aberrant type, but that it is, in fact, a member of a large group of beings, hitherto almost entirely overlooked, which play apparently a most important part in the œconomy of nature. I have determined upwards of fifty species of this curious sponge, all inhabiting more or less diversified chambers in calcareous substances, and in other respects well-characterized. Of these species twelve belong to the British seas; the rest are from various parts of the world. I have also ascertained that *Cliona* existed during several geological periods, and with the assistance of Mr. W. K. Loftus have determined that it occurs in the crag, in the London clay, in the Paris basin, in the chalk, in the greensand, and in the oolite; and Mr. Alder has detected it in specimens of *Pecten Islandicus* from a raised beach on the coast of Bute. In most instances the characters of the

chambers are so well preserved in the fossil shells of these formations that the species may be determined.

A new generic form has also been discovered : it is closely related to *Cliona*, and like it conceals itself in calcareous bodies. Two or three species have occurred : they and several of the more characteristic species of *Cliona* that have come under my notice will be described in the sequel of this communication : the others are reserved for some future occasion.

It is now upwards of twenty years since Professor Grant's paper on *Cliona celata* appeared in the 'Edinburgh New Philosophical Journal'; and in 1840 M. Duvernoy described in the 'Revue Zoologique' another species inhabiting the shell of *Ostrea hippopus*. These I believe are the only species hitherto known, though extensive traces of the genus are to be found in every cabinet of shells, and probably on every shore of the British islands.

Professor Grant believed *Cliona* to be polypiferous. Such belief, however, has not been confirmed by subsequent observations, which seem on the contrary to prove that this production is truly a sponge, differing but little in internal structure from *Halichondria*. I have examined with much care the papillæ of *Cliona* when just removed from the sea, but have not succeeded in detecting any polypes. The propriety, nevertheless, of retaining it as a distinct genus would appear evident ; for though it undoubtedly possesses many characters in common with *Halichondria*, yet *Cliona* differs widely from it in its habits, and particularly in its contractile power,—a quality surely of great importance, raising *Cliona* in the scale of creation high above the sponges in general.

From this striking character it perhaps might be inferred that *Cliona*, and likewise *Thoosa*, by which name I propose to designate the new generic form, are closely related to *Tethea*, which is stated to be irritable ; and as the two former are both provided with siliceous bodies or granules on the surface, as will be afterwards shown, they would also appear to be allied to *Geodia*, the external covering of which is composed of siliceous globules.

The numerical extent of the species of *Cliona* cannot at present be estimated. Those now recorded are the result of a very limited investigation. That they are very numerous is evinced by the fact, that from a single specimen of *Tridacna gigas* a dozen species at least have been obtained. They are not merely specifically numerous, but are likewise individually so ; and they attack inorganic as well as organic bodies. They appear to be pretty generally diffused over the surface of the globe, though most numerous in warm climates : none have been yet procured from the Polar regions.

On the coast of Northumberland the surface of almost every piece of limestone near low-water mark is riddled by *Cliona*: old shells, whether univalves or bivalves, are filled with it; it inhabits nullipores; and in southern latitudes it buries itself in corals. Its ravages are very extensive and appear to be rapidly effected. I have seen half-grown living oysters with *Cliona* extending from the umbones almost to the ventral margin, and in one or two instances it even reaches that margin. In these cases it is evident that the growth of the sponge must have been more rapid than that of the shell; for the work of destruction could not commence until the oyster had attained to some size; and had its growth been even equal to that of the sponge, the shell ought to have reached its full development before the sponge had gained the lower margin.

When a shell is once attacked, the operations of these creatures never cease until they have extended throughout its entire substance. The middle portion soon becomes almost completely excavated, small pieces only remaining to divide the chambers or branches. A thin plate is left on the outer and inner surfaces to protect the parasite; and even these plates are ultimately riddled with numerous circular holes, which are the only indication of the work of destruction beneath, until some slight external influence ruptures the protecting walls, or the increasing growth of the tenant bursts them asunder; when the whole system of elaborately wrought chambers becoming exposed soon gives way, and *Cliona*, Sampson-like, perishes amidst the ruin produced by its own energy.

The excavating sponges abound in the Tropics, where they will keep in check the rapid increase of calcareous matter. The coral reef is built up by particles, and so by particles will it be reduced by the antagonism of these ever-working, all-pervading beings: the huge massive *Tridacna* falls in pieces subjected to the insidious encroachments of *Cliona*; and the limestone rock, almost bidding defiance to elemental influences, crumbles beneath the touch of this the lowest of animated beings.

It is difficult to say whether certain species of these parasites confine their ravages or not to certain shells or other calcareous bodies, though the fact of twelve species occurring in a single individual of *Tridacna* would appear to contradict such an opinion. Three or four distinct species are likewise found in the common oyster, and one of them occurs in limestone: *Fusus antiquus* has also supplied three good species. On the other hand *Cliona radiata* would appear to be confined to *Triton variegatus*, in two or three specimens of which it occurred abundantly; *Murex regius* is frequently affected by the operations of *Cliona*, and always, as far as I have been able to ascertain, by the same

species. And the three individuals of *C. corallinoides* that I have procured are buried in as many specimens of *Pecten maximus*. All these cases, however, may arise from similarity of locality, and not from any partiality to the species.

The boring sponges, as far as I have examined them, are branched, or are composed of lobes united by delicate stems; and all more or less anastomose according to the species: many of them are beautifully arborescent and of great delicacy*. They all bury themselves in shells or other calcareous bodies, and communicate with the water by papillæ or oscula protruding through circular holes in the surface of the containing substance or matrix. In dead shells the papillæ pass through both surfaces, but in living ones rarely penetrate the innermost layer, though occasionally they do so. When a mollusk is thus wounded it deposits calcareous matter over the orifice, and generally succeeds in excluding the intruder. The species vary considerably in form, and in *Cliona* might be divided into two or three distinct groups. In some the branches are almost linear, and anastomose only to a very slight degree; others form a complete network with the meshes so small that very little of the matrix remains between the branches; some have the branches moderately lobed; and others again have the lobes large and crowded upon each other in all directions, and united by fine, very short stems. In most the terminal twigs are very minute, and exhibit in a decided manner the mode of growth. In *C. gracilis*, for example, we perceive that they are cylindrical, and divide dichotomously, and that afterwards they augment in thickness gradually and pretty regularly, there being only slight indications of a lobed structure. In *C. corallinoides*, Pl. XV. fig. 1, the twigs are excessively minute, passing onward for some distance through the sound shell; and as they increase they become gradually lobed, the lobes ultimately attaining considerable size and becoming quadrate. This mode of growth is common to a great number of species: in some it is beautifully modified, as we see in *C. spinosa*, Pl. XIII. fig. 5; here the terminal twigs are mostly short and pointed, resembling spines thrust out from all sides of the close-set lobes; which spines or twigs in their turn swell out and become lobes. But of all the excavating sponges, *Thoosa caetoides*, Pl. XIII. fig. 1,

* Dr. Johnston describes *C. celata* as "without beauty or definite form;" but the specimens he examined may have been of abnormal growth, resulting perhaps from the entire destruction of the substance which had inclosed them. The Doctor's species however appears to be distinct from the *C. celata* of Grant, judging by the spicula, which, according to the figures of them by Mr. Bowerbank, are perfectly straight. In the species described by Professor Grant they are stated to be "slightly curved and a little fusiform in the middle."

is perhaps the most remarkable: in this the terminations of the branches have a decided dendritic appearance; they divide pretty regularly into two portions, which send off on all sides numerous, minute, linear twigs. The two principal portions soon swell out and form into oval lobes similar to those of the stems, which are seen likewise to give off linear twigs. These twigs and those of the terminal branches are so much alike, that it is impossible to doubt that the lobes of the stems have at one time been themselves terminal branches.

Thus is the form of the excavating sponges varied, and the chambers they inhabit modified; each species being always found in the same-formed cavities; that is, those with the same kind of spicula, and with papillæ of the same size, number and arrangement, are always found to branch and to anastomose in a similar manner, and to have the terminal twigs of the same character. This surely could not happen, did *Cliona* take up its abode in cavities caused by decay, or in excavations formed by worms, and were its shape dependent upon such accidental circumstances.

The cavities in shells occupied by *Cliona* have at once, without examination, been attributed to worms; and as inquiry was thus easily satisfied, the matter has remained up to the present time in obscurity. Those naturalists, however, who have paid particular attention to the subject appear inclined to a contrary opinion. Professor Grant says, the chambers "have probably been perforated by some worms;" though at the conclusion of his communication before alluded to on the subject, it is stated that "it may be questioned whether the sharp siliceous spicula and constant currents of its papillæ do not exert some influence in forming or enlarging the habitation of this zoophyte." By Johnston's work on the British sponges it also appears that Mr. Wm. McCalla, who found *Cliona celata* in Birterbuy bay, states that this animal "is very destructive to the shells that come within its reach," and that in several instances "he had found large specimens of *Pecten opercularis* killed by the encroachments of this parasite." And so satisfied was M. Duvernoy that the species described by him excavated its own habitation, that he gave to it the specific denomination of *terebrans*. The prevailing belief is as before stated, however, that *Cliona* does not excavate the chambers in which it is found; but that they are formed by worms or by decay, or are produced in some other accidental manner; and that the shape of the sponge depends on that of the cavities it may chance to inhabit. Were this belief correct, the chambers would occasionally occur only partially occupied. This never happens; for *Cliona* always completely fills the various chambers and ramifications even to

the end of the most minute twigs. To this we have the testimony of Professor Grant, who says that the form of *Cliona* "depends on that of the cavities *which it fills* ; it insinuates itself into the minutest ramifications, and adheres so closely to their smooth parietes, that it cannot be separated without tearing."

From what has already been said respecting the form and mode of growth of these sponges, it is pretty evident that they must form their own habitation. But to put this in a still clearer light we have only to examine in detail any one species : we will take *C. gorgonioides*, Pl. XIV. fig. 1, as an example. The principal stems of this species take a zigzag direction, sending off at the angles lateral branches which pass on to unite with the neighbouring stems : the terminal twigs are delicate and bifurcate, one of the divisions going immediately to form its junction with the adjoining stem. This mode of growth goes on until the entire substance of the shell in which the *Cliona* is lodged is completely filled with a network of branches ; the anastomosing increasing all the while by the addition of twigs from the main stems until very little of the shell is left to separate the various parts of the sponge. Now in all this there is nothing having the appearance of accident. Where the *Cliona* is not, the shell is perfectly sound and untouched : the terminal twigs are all alike delicate and of similar character, penetrating the hard perfect substance ; the main stems become gradually and proportionately thick, and the anastomosis, though somewhat irregular, is identical throughout. And this takes place whether the specimen is buried in *Fusus*, in *Buccinum*, in *Ostrea*, or in limestone, in all of which this species occurs.

Now if we assume for a moment that these sponges are incapable of excavating the chambers in which they conceal themselves, how shall we account for the formation of the beautiful dendritic cavities occupied by the terminal twigs of *Thoosa cactoides*, Pl. XIII. fig. 1, and the regularly anastomosing and lobed chambers filled by its branches ? How are the arborescent channels and quadrate chambers of *C. corallinoides*, Pl. XV. fig. 1, formed ? and what excavated the numerous, regular chambers, with their pointed spine-like offsets, of *C. spinosa*, Pl. XIII. fig. 5 ? How shall we answer these questions, unless we can assert that the sponge inhabiting those systematic cavities formed them ? They are evidently not the result of decay, neither are they the burrows of worms ; which, when in shell or other hard calcareous substance, are always linear, sometimes cylindrical, often depressed, never lobed, and frequently double, that is, with two channels divided by an elevated ridge. And so different are they in their general appearance, that it is very easy to point out which is the excavation of the worm, and which that of *Cliona*,

when the burrows of the two interfere with each other, which not unfrequently occurs.

There is, however, a very certain character which never fails to determine the habitation of the burrowing sponge, even though every particle of the animal be removed. If the parietes of the chambers and ramifications are viewed through an ordinary lens, they are found to be distinctly punctured in a peculiar manner, resembling what might be supposed to be the impress of shagreen, only much more minute. In some species this puncturing is much finer than in others, and occasionally it varies a little in character; but is always to be observed on the walls of the burrows of these sponges, whether they be in shell, limestone, coral, or nullipore. This puncturing therefore cannot be caused by the structure of the material in which the chambers are excavated, but must result from the character of the surface of their inhabitant. So certain a test is this, that by it alone the nature of the excavations in fossil shells may be determined with the greatest confidence. No other excavation, whether of worm or mollusk, presents a surface anything like that of the burrows of these sponges. And were no other proof at hand, this puncturing would be sufficient to establish the fact that these sponges possess the power of enlarging their habitation; but when taken in connexion with what has already been said, little doubt can exist of the fact that *Cliona* entirely excavates its abode: indeed after an examination of the form of these beings, and of the branched, lobed and systematic cavities they occupy, it would seem impossible to arrive at any other conclusion. On this point, however, I possess, if possible, still stronger evidence.

Through the kindness of Mr. Fryer I have had the examination of an individual of *Placuna placenta*, in the shell of which there are imbedded numerous specimens of a very beautiful *Cliona* exhibiting every stage of development from the earliest to maturity. This shell is so transparent, that even the minutest twigs are seen with the greatest precision. At first the young *Cliona* is a mere circular speck just visible to the naked eye; Pl. XIV. fig. 4 *a*, represents it in this stage sunk within the substance of the shell, through which there is a papillary puncture almost as large as the individual itself: afterwards the circle increases in size around the papilla, and becomes irregular in form, *b*; a thin linear branch is then pushed out from one side, *c*, and throws up through the shell another papilla. A branch from the opposite side now makes its appearance, *d*; a third and a fourth succeed, *e*, *f*; these are now seen to divide gradually into lobes, and to increase in thickness; numerous papillæ, *f*, being added, which penetrate the surface of the shell, and the terminations of

the branches bifurcate;—in short the young *Cliona* has now assumed the character of the mature sponge (fig. 2). Thus we can trace *Cliona* from its earliest stage of growth,—not larger than the gemmule of *Halichondria* and resembling it in form,—up to its perfect development, step by step, excavating its complicated habitation in sound shell, within which it lies closely imbedded, but unobscured by its pearly envelope which is perfectly free from decay and is untouched by worms: to neither of which by any constrained imagination can the chambers in this instance be attributed;—*Cliona* makes them for itself. And now having, I trust, established this fact, we shall endeavour to ascertain the nature of the apparatus by which these sponges work out their abode,—a subject of much difficulty.

The mollusks being furnished with a shell, the investigation into the nature of their excavating instrument is much complicated. The burrowing sponges, however, having no such hard covering, we have in them only the animal to look to for an explanation. The excavations of *Cliona* and *Thoosa* can only be effected by the surface of the sponge, aided either by some minute mechanical instruments in connexion with it, or by a solvent: unless, indeed, the water-currents of the papillæ, as hinted by Professor Grant, be thought equal to perform the task. But were these currents of sufficient magnitude to penetrate rapidly into shell or hard limestone, it is difficult to see how they could be brought into effective operation. The papillæ are closely adherent to the sides of the orifices through which they protrude; and here the water could have no effect; and yet these orifices are at first small, and are afterwards considerably increased in size. And at those points where the water is drawn into the sponge, the currents, of course, cannot be supposed to act in the way proposed. To show, however, how inadequate these minute currents are to work out the chambers of *Cliona*, which we have seen are formed very rapidly, we have only to reflect on the comparatively slow action of the enormous currents of the sea,—of the tidal currents, and of those resulting from the lashing of the waves. The puncturing of the sides of the chambers also seems unfavourable to such an hypothesis. We shall not therefore stop to discuss this branch of the subject further, but at once inquire how far a solvent is likely to be the agent.

The extreme simplicity of the organic structure of these beings forbids a belief in the existence of a special secreting apparatus. If therefore a solvent fluid be the agent, it must be supposed to exude from the entire surface of this humble animal. The character of the excavations would also lead to the same conclusion; for it is evident that the form of the sponge is influen-

tial in determining that of the chambers it inhabits. The test then can be easily applied; and were the secretion of an acid nature, there could be little difficulty, one would think, in detecting it; particularly as *Cliona* appears to work perpetually—at least so long as it continues to grow. I have completely failed, however, in detecting an acid.

I took *C. gorgonioides* alive fresh from the sea, and breaking up the stone in which it was lodged removed the creature by piecemeal, and placing each portion on litmus-paper pressed the fluids out of it between plates of glass; but not the slightest alteration occurred. I continued trying piece after piece for several hours, and contrived to remove portions of the animal with the surface entire; but all was in vain,—no indications of an acid solvent could be obtained.

In a specimen of the *Strombus gigas* in the Newcastle Museum penetrated by a species of *Cliona*, the papillæ have passed through the strong horny epidermis, drilling it with great precision; the holes are quite circular, and of the same size as those in the shell. This could hardly be achieved by an acid solvent.

When a portion of the fresh *C. celata* is carefully removed from the chambers and placed in a little acetic acid, a distinct effervescence takes place as if calcareous matter mingled with the tissue. The same result occurs when a little of the dried substance adhering to the sides of the excavations of *Thoosa* is removed and treated with the same acid. From these facts we may conclude, perhaps, that no acid solvent had been employed; while it is likely, were the excavations effected by mechanical means, that the surface and tissue would be charged with calcareous particles. Indeed such particles may generally be observed strewn along the branched channels in the shell of the oyster when inhabited by *C. celata*. I have also seen similar calcareous particles adhering to the animal of *C. gorgonioides* when removed from its chambers in limestone. These particles are large enough to be detected with a pocket lens, and will be more fully described further on. At present they are alluded to, as they afford a pretty strong proof of mechanical agency.

The excavations would then appear to be effected by mechanical, and not by chemical means. What is the instrument, and how is it applied?

With respect to *Cliona*, it is well known to possess siliceous spicula; some of the points of which penetrate the surface of the animal, and might be supposed capable of reducing the calcareous bodies in which these creatures bury themselves. But other and apparently more efficient agents have been discovered, covering the surface of the sponge.

The superficial covering of the animal of *C. celata*, Pl. XIII. fig. 3, is liable to adhere to the sides of the excavations. If a portion of this is carefully removed and placed between plates of glass with the external surface uppermost and treated with strong nitric acid, large crystalline bodies of a peculiar character are discovered scattered over it (Pl. XII. fig. 1). These bodies are of a pale straw colour, and of the most brilliant lustre and gem-like beauty; the largest measuring $\frac{1}{600}$ th of an inch across: they are mostly irregularly six-sided, depressed, and scale-like; but stout and frequently thickened in the centre, the upper surface being covered with numerous, elevated, lozenge-shaped points, each generally having an expanded base of a squarish form slightly raised above the common surface (fig. 2). These bodies are frequently congregated into groups, and are occasionally placed together side by side. Strong nitric acid does not the least affect them after many days' immersion, the sharp angularity of the elevated points remaining unimpaired, and their brilliancy undiminished. From these facts, and from the manner in which these bodies refract light, there can be little doubt that they are composed of silex, or some other substance equally dense. Besides these other crystalline bodies crowd the surface, which bodies are as brilliant as the former, and like them resist strong nitric acid. These are mostly minute, being generally $\frac{1}{6000}$ th of an inch wide; they vary, however, considerably in size, and are occasionally very much larger: they are mostly angulated, have an expanded scale-like base, and much resemble the lozenge-shaped points of the larger bodies. These smaller ones are crowded together into dense masses, forming as it were a sort of silicified epithelium; occasionally they become united by the blending of their expanded bases, and then the combined mass has considerable resemblance to the larger forms before described.

Similar minute siliceous granules have been observed in all the species examined. The allied genus *Thoosa*, too, has the surface provided with siliceous bodies of a very peculiar and novel appearance. This genus is unfurnished with spicula in the interior, but has occasionally radiating ones supplying the surface, which is almost entirely composed of the siliceous bodies just alluded to.

If a portion of the animal adhering to the chamber-walls of *Thoosa* be removed and placed with the surface uppermost, and examined in the microscope as an opaque object, it is seen to be covered with a whitish semi-pellucid crust of a granular appearance; on increasing the power to about 200 diameters, this crust is seen to be composed of a multitude of crystalline bodies formed of nodules. On examining these bodies by transmitted light with a still higher power (400 diameters), they are observed to rest on a thin membrane distinct from the substance

below, which is almost entirely made up of tubes. The form of these bodies, Pls. XII. & XIII. fig. 10 *a*. & fig. 2 *b*, is now observed to be somewhat like that of the mulberry, and on closer examination they are found to be composed of a stout central axis, near each extremity of which is placed a whorl of six or eight large, irregularly quadrate nodules; the extremities of the axis being each formed of a nodule similar to those of the whorls. These bodies measure $\frac{1}{175}$ th of an inch long, are colourless, refract light powerfully, and are as brilliant as the spicula, and in like manner are unaffected by strong nitric acid, how long soever subjected to its action.

It is to the above-described peculiar siliceous bodies on the surface of the excavating sponges that I attribute the power they possess of burying themselves in calcareous substances. The spicula may perhaps assist in *Cliona*; but they seem ill-adapted for the purpose in *Thoosa*, and indeed are not always present. In the former they undoubtedly penetrate the surface, and originally I was inclined to look upon them as the chief agents employed. The discovery of the mulberry-like bodies on the surface of *Thoosa* led me to examine more closely that of *Cliona*, and after finding there those beautiful gem-like crystals, so well adapted for cutting, their homology cannot be doubted; and I am compelled to adopt the view just expressed.

The surface then of these animals will very much resemble what I have elsewhere described the cutting surface to be in the boring mollusks; in the former as in the latter every portion of it will cut with the keenness of glass-paper; and as *Cliona* is admitted on all hands to be highly contractile, there can be no difficulty respecting the capabilities of the excavating apparatus as just described. All that is necessary is, that each siliceous granule, or cluster of granules, should be put in motion. Action,—very limited,—not more extensive than that of vibratile cilia, would be sufficient; and it would seem not at all improbable that it may be of the same nature. From Ehrenberg's investigations it would appear that the motion of these minute organs is produced by a contractile tissue on which they are based, and that in some of the animalcules they have a rotatory motion. Now if we suppose these siliceous bodies of *Cliona* and *Thoosa* to be in connexion with a similar contractile tissue, the whole surface of the sponge would be composed of thousands of minute drills quite able to cut into calcareous substances of the hardest nature.

Were the action of this character, the walls of the chambers would be drilled full of little holes, and would present just the appearance we have already seen they possess. And as the calcareous particles were removed they would be carried away by the

ordinary currents, which setting in from the surface of the sponge would convey the reduced matter into the principal channels, by which it would soon find an exit through the efferent papillary apertures. I have before alluded to calcareous particles found strewn along the channels inhabited by *C. celata*. These particles, measuring $\frac{1}{200}$ th of an inch long, are apparently too large to escape through the pores of the sponge, and are evidently not the scourings of the excavation; they are much too large to arise in this way; but are pieces probably cut out by a combination of the minute drills just described. To understand how this may be effected, we have only to suppose that numerous punctures are made through a thin, slightly attached plate or lamina of the oyster-shell, and that interspaces are left between the punctures; and it is clear that as the drilling goes on, many of these interspaces will become detached in the form of depressed, many-sided, angulated bodies. And such are those that are found in the channels of the excavations. Those particles of a similar nature occurring in the chambers in limestone are undoubtedly produced much in the same manner.

In the siliceous granules on the surface, and in the contractility of these sponges, we thus find an explanation of their excavating powers.

We shall conclude this communication with the description of a few of the species, premising that the figures of the spicula represent them drawn to a scale, so that at a glance a pretty correct idea may be obtained of their relative sizes. And it is as well perhaps to observe, that in every instance the full-developed spiculum has been measured and figured.

Cliona celata, Grant. Pl. XIII. figs. 3 & 4.

C. celata, Grant, Edin. New Phil. Journ. vol. i. p. 78.

C. celata, Johnston, Br. Sponges, p. 125?

Sponge of a clear yellow-ochre colour occasionally inclining to olive, composed of a large open network of branches; the meshes irregularly angulated, frequently five- or six-sided, and occasionally half an inch wide; the branches stout, often $\frac{5}{16}$ ths of an inch thick, distinctly nodulous and generally depressed: papillæ large, some measuring $\frac{1}{16}$ th of an inch in diameter*; for the most part in a single row along the branches, but penetrating the surface of the matrix without much apparent order, and placed rather far apart from each other: terminal twigs rather short, delicate, almost linear, and generally bifurcated. Spicula very long, measuring upwards of $\frac{1}{30}$ th of an inch in length, a little

* In this and in the following descriptions the diameter of the papillæ has been determined by that of the papillary punctures.

bent, not particularly stout, and sometimes slightly inclined to fusiform, but tapering pretty gradually to a sharp point at one end; the other furnished with a well-defined globular head approaching to ovate with generally a terminal point.

This appears to be the most destructive species to oyster-shells, and abounds in the Frith of Forth. It is undoubtedly the *C. celata* of Grant: the form and large size of the spicula are sufficient to distinguish it. The *C. celata* of Dr. Johnston, however, is most likely another species, as the spicula are somewhat different.

C. insidiosa. Pl. XV. fig. 5.

Sponge when dry of a brown colour, branched; the branches about $\frac{3}{16}$ ths of an inch thick, irregular, anastomosing: papillæ distant, irregularly arranged, rather small. Spicula $\frac{1}{117}$ th of an inch long, stout, sometimes slightly fusiform, but generally tapering gradually to a fine sharp point at one end, towards which it is generally slightly bent; the other extremity is furnished with a large globular head separated from the shaft by a distinct dusky line, and mostly a little flattened like the head of a pin.

This species, which occurs in *Tridacna gigas*, appears related to *C. gorgonioides*; like it this has only one kind of spicula, and in both they are furnished with a rounded head. A cross section of the excavations of this form has much the appearance of a similar view of those of that species. I have not been able to trace the terminations of the cavities, and therefore cannot speak to their form. The short, stout spicula of *C. insidiosa* with their large pin-like head are very characteristic, and readily distinguish it from its congeners.

C. gorgonioides. Pl. XIV. figs. 1 & 6.

Sponge of a brownish yellow colour, branched, anastomosing; the principal branches stout, sometimes nearly $\frac{1}{8}$ th of an inch thick, irregularly rounded, or depressed, placed somewhat parallel to each other, and much zigzagged, giving off lateral branches at the angles, which branches unite with those adjoining: terminal twigs thin, tapering to a fine point and bifurcating: papillæ large, frequently almost $\frac{1}{16}$ th of an inch in diameter, penetrating the surface of the shell or other matrix without apparent order, and placed considerably apart from each other. Spicula very numerous, large and stout, measuring $\frac{1}{94}$ th of an inch in length; at one end there is an oval swelling which is frequently some little distance from the extremity: from thence the shaft gradually tapers to the other end, which is sharply pointed and is generally much bent, particularly towards the

enlarged extremity; and sometimes the pointed end is a little recurved, giving to the spiculum a slight S-like twist.

This species is common on the coast of Northumberland, where almost every piece of limestone at low-water mark has the surface riddled by it: it likewise occurs in the shell of *Fusus antiquus* and *Buccinum undatum*. I have obtained it also in oyster-shells from Prestonpans. The walls of the burrows of this form are strongly punctured, and every here and there are drilled with small conical holes. When in the thin shell of *Fusus* or *Buccinum*, the branches are all confined to the same plane, and then this species has considerable resemblance to a *Gorgonia*. But when it takes up its abode in limestone, the branches frequently pass vertically to some depth into the substance of the rock, giving to the sponge a very complicated structure.

In old specimens the branches become less regular, increasing much in thickness and number until very small spaces divide them: the external walls are now liable to give way, and the sponge being thus exposed must either perish or sink deeper into the matrix.

C. radiata. Pl. XV. fig. 3.

Sponge delicately branched in a radiating manner; the branches being $\frac{1}{16}$ th of an inch thick and divided at unequal distances into elongated lobes: terminal twigs simple, minute, linear: papillæ rather variable in size, frequently very small, placed in a single close-set row along the branches; in the central axis where the branches unite there is one much larger than the rest. Spicula $\frac{1}{8}$ th of an inch long, stout, straight, frequently a little bent; one end with a large ovate head widest at its junction with the shaft, which is a little constricted at the point of union, and from which it is strongly defined by a dusky shadow.

This form buries itself in the shell of *Triton variegatus*, and is easily recognized on the surface by the radiating lines of minute close-set papillary punctures. It is very destructive to the shells it attacks: at first it is composed of a few simple radiating branches; these afterwards enlarge, and send off lateral shoots which anastomose with the adjoining branches, and ultimately fuse, as it were, towards the centre, which becomes one mass of sponge frequently an inch wide; all the shell, of course, at this part being entirely removed.

C. gracilis. Pl. XIV. fig. 7.

Sponge composed of a few long, slender, linear branches, rarely if ever anastomosing, extending in length upwards of 5 inches, and only $\frac{1}{16}$ th of an inch thick, with a few distant, indistinct constrictions indicating an approximation to a lobed structure:

terminal twigs regularly bifurcating, the branches have consequently a dichotomous arrangement : papillæ placed rather far apart, small, of equal size, and arranged in a single row along the branches, the direction of which they distinctly indicate on the surface of the matrix. Spicula of two kinds ; the larger about $\frac{1}{77}$ th of an inch in length, generally a little bent, stout and inclining to fusiform, with the pointed end gradually tapering ; the opposite extremity provided with a rounded head, somewhat elliptical, and merging imperceptibly into the shaft. The smaller spicula are about $\frac{1}{3}$ rd the length of the larger ones, and are less stout ; they bend gradually in the centre, from whence they taper to a fine point at each end.

I have seen only one specimen of this species ; it is in *Pecten maximus*, most probably from Orkney, and extends from the beak to the ventral margin. The spicula somewhat resemble those of *C. corallinoides*, but are considerably stouter ; and though the heads are large and well-formed, they are not so distinctly marked as in that species ; and the smaller ones bend less abruptly : the character of the branches is also remarkably different.

The walls of the excavations of this species are rather finely punctured.

C. muscoides. Pl. XV. fig. 11.

Sponge formed of numerous delicate, much-divided, closely and irregularly anastomosing branches, with the terminal ones very slender and composed of an open network ; the principal branches about $\frac{1}{16}$ th of an inch thick, and distinctly seen ramifying throughout the general interlacement of the sponge : papillæ small, very numerous, approximating, and where the anastomosis is extensive, without apparent order ; towards the terminal branches however they run in rows, and betray the course of the branches on the surface of the shell in which the specimen is buried. Spicula of two kinds, one with heads, the other with both ends pointed ; the former, measuring $\frac{1}{140}$ th of an inch in length, are generally straight, proportionately stout, and with two globular heads, one terminal, though not always perfectly so, and one placed at a little distance down the shaft ; occasionally there is an additional head a little way below the second ; from this end the shaft tapers gradually to a sharp point at the opposite extremity, towards which there is frequently a slight bend. The other kind of spicula are fusiform and as stout as those with heads, but only half their length ; they taper gently to both ends, which are finely pointed, and bend abruptly in the centre, where there is frequently a nodulous swelling ; there is also occasionally another indistinct nodule or two on each side of the centre one and at some little distance from it.

I have seen only one specimen of this interesting species ; it occurs in the shell of *Monoceros fusoides* in the Newcastle Museum. It has injured nearly the whole surface of the body-whorl, and has extended its ravages over most of the spire.

C. Howsei. Pl. XIV. fig. 8.

A small delicately branched and closely anastomosing species with the branches slightly lobed or nodulous: terminal twigs slender, long, linear, and rather acutely bifurcating, and anastomosing widely for a considerable length backwards; afterwards the meshes become very much reduced in size by the addition of branches. In the older parts, where the anastomosis is very dense, the meshes being about $\frac{1}{12}$ th of an inch wide, the lobes or nodules are most distinct; they rarely exceed $\frac{1}{16}$ th of an inch in diameter: papillæ very fine and close-set, running in a single row along the branches, and generally so disposed that the anastomosis can be easily followed by the perforations they make in the surface of the matrix, but from their minuteness might readily escape observation. Spicula very delicate and about $\frac{1}{100}$ th of an inch long; there are two kinds; one is generally straight and tapers to a very fine, slender point at one end, and has at the other a well-marked terminal head, which is short and broadly ovate, with the apex at the extremity, and sometimes a little prolonged: the other kind of spicula is generally a little longer than the preceding, and is mostly somewhat bent, but is likewise slender and gradually diminishes to a fine point at one extremity; the other is most commonly furnished with two heads; one is terminal or nearly so, the second is placed about $\frac{1}{3}$ rd down the shaft: it also frequently happens that the terminal head is wanting.

This species is so very distinct in all its characters, that it cannot well be confounded with any other British form. Its slender, delicate branches, small and regular papillary punctures arranged in anastomosing lines, and its characteristic two-headed spicula at once distinguish it. Only two specimens have occurred, one in *Fusus antiquus* from the Dogger-bank, the other in a nullipore procured from the beach at Tynemouth. For these and for several other specimens I am indebted to Mr. Richard Howse, after whom this species is named.

C. Northumbrica. Pl. XIV. fig. 5.

Sponge when dry of a pale yellow colour, branched, closely and irregularly anastomosing and indistinctly lobed; the larger lobes being sometimes $\frac{1}{8}$ th of an inch across: papillæ rather small, seldom more than $\frac{1}{30}$ th of an inch in diameter, placed considerably apart along the branches, but appearing numerous,

regularly distributed and rather closely set on the surface of the matrix. Spicula of two kinds ; one, much the larger, measures $\frac{1}{77}$ th of an inch in length ; it has at one extremity a large rounded head, is straight, and tapers gradually to a sharp point at the other : the smaller spicula are scarcely more than $\frac{1}{4}$ th the length of the former, are rather stout, fusiform, sharp and gradually pointed at both ends, and much and suddenly bent in the centre, where they are thickest.

I have seen only two specimens of this species : they occur in individuals of *Fusus antiquus* brought from the Haddock grounds by the Cullercoats' fishermen. This may be at once distinguished from *C. gorgonioides* by the spicula, that species having only one kind, this two : but the form of the larger kind, which is common to both species, is sufficiently distinct ; its head in those of *C. Northumbrica* is almost always quite circular and is at the extreme end ; and moreover they are rarely bent, and when so only very slightly. The branches too are indistinctly lobed in this species, but are never so in *C. gorgonioides*, and the papillæ are smaller and more numerous. Unfortunately I have not seen the terminal twigs, as the only two specimens procured of this species had entirely overrun the shells they had attacked. In both instances, the shell being dead, the papillæ had perforated each surface.

C. Alderi. Pl. XV. fig. 9.

Sponge branched, irregularly and widely anastomosing, and strongly lobed ; the lobes for the most part irregularly rounded, frequently $\frac{1}{6}$ th of an inch wide, placed close together, and united by a much-constricted stem : terminal twigs very fine, frequently linear for a considerable length, and bifurcating somewhat irregularly : papillæ small, rather variable in size, the largest about $\frac{1}{40}$ th of an inch in diameter, placed rather far apart in a single row along the branches on the surface of the matrix ; they appear occasionally to run in lines. Spicula of two sorts ; one $\frac{1}{116}$ th of an inch long, moderately thick, slightly bent, with a small oval head near one end, and tapering to the other extremity : the second kind is scarcely shorter than the former and has one end truncate, the opposite pointed, and is decidedly bent in the centre. The puncturing of the walls of the chambers is distinctly visible with a low magnifying power.

This species is named after my friend Mr. Alder, who took several specimens of it in *Pectunculus pilosus* on the coast of the Isle of Man : as yet it has occurred in no other locality.

C. corallinoides. Pl. XV. figs. 1 & 2.

Sponge freely and distinctly branched, slightly anastomosing, and regularly and strongly lobed ; the lobes about $\frac{1}{8}$ th of an inch

wide, and somewhat obtusely quadrate, a little longer than wide, placed end to end and united by a slender, central, cylindrical stem: terminal twigs exceedingly slender, almost linear, giving off lateral shoots, and irregularly bifurcating: papillæ variable in size, some being nearly $\frac{1}{24}$ th of an inch in diameter, while others are very much smaller, arising from the lobes without order; some of the lobes having only one papilla, others three or four. Spicula $\frac{1}{70}$ th of an inch long, slender, generally bent in the centre, tapering gradually to a sharp point at one end, and at the other furnished with an elliptical head defined at its junction with the shaft by a dusky line. Besides these there are other spicula of a different form which are equally numerous with those just described, but are much smaller and very delicate, measuring scarcely $\frac{1}{3}$ rd their length: these smaller ones are fusiform, with both extremities sharply pointed, and are suddenly bent in the centre.

This beautifully branched species occurs in British specimens of *Pecten maximus*, but the exact locality is not known. Three examples have been procured. In all the papillary punctures are very variable in size, and indistinctly indicate on the surface of the shell the various ramifications of the sponge; and in all the specimens the branches could be perfectly distinguished likewise on the inner surface. Here the sponge had made innumerable minute punctures, which the mollusk had endeavoured to close up by an accumulation of calcareous matter, covering the entire track of the branches with small granules.

The walls of the excavations of this species are strongly and regularly punctured.

C. Fryeri. Pl. XIV. figs. 2, 4 & 9.

Sponge formed of lobed branches arranged in a somewhat radiating manner, and irregularly anastomosing, with a few scattered, spine-like processes; the lobes about $\frac{1}{10}$ th of an inch wide, considerably elongated, with the ends truncate, and united by a much-constricted central stem: terminal twigs short, almost linear, bifurcating: papillæ small, arranged in a single row along the branches, generally two or three to each lobe. Spicula of two forms: one, considerably larger than the other, generally measuring $\frac{1}{116}$ th of an inch in length, is straight, and furnished at one end with an oval head; from thence it tapers imperceptibly to the other extremity, which is finely pointed. The other form of spiculum is almost cylindrical, slightly curved, with the ends brought abruptly to sharp points.

This beautiful species is imbedded in the shell of *Placuna placenta*, in the possession of J. H. Fryer, Esq. of Whitley House, after whom it is named, and to whose interesting and extensive

collection I am indebted on this, as on a former occasion, for much valuable assistance.

On account of the transparency of the shell the whole of the sponge is exposed to view, as well as a series of the young exhibiting every stage of development. The walls of the chambers of this species are strongly punctured.

C. spinosa. Pl. XIII. figs. 5 & 7.

Sponge branched, regularly anastomosing; the branches along their entire course swelling into large lobes measuring nearly $\frac{1}{12}$ th of an inch wide: terminal twigs minute, tapering, having a spine-like appearance, generally simple, but frequently a little branched: papillæ numerous, for the most part small, with one here and there very much larger than the rest; the largest about $\frac{1}{12}$ th of an inch in diameter. When the sponge is in a growing state, the papillæ penetrate the surface of the matrix in single rows in a somewhat branched manner, but as the growth matures and the anastomosis goes on, this arrangement is lost; and ultimately the papillæ are pretty regularly distributed over the whole surface. Spicula of two kinds; one has a globular head at one end, is rather stout, straight, $\frac{1}{87}$ th of an inch long, and tapers gradually to the opposite extremity, where it terminates in a fine sharp point: the other kind is fusiform, and is scarcely $\frac{1}{3}$ rd as long as that with a head, and is much less stout; it is bent suddenly in the middle, and from thence tapers gradually to the ends, which are very sharp and a little recurved.

Of this species I have seen at least four individuals in the valves of *Perna femoralis* and *Placuna sella*, and these I have been able to examine with great facility, on account of the transparency of the inner layer of shell through which the lobed branches with their terminal twigs are most distinctly visible, the internal puncturing giving to them a pretty silvery appearance, and rendering the whole under a lens an object of great beauty. In the *Placuna*, which measures 6 inches wide, the ramifications of the sponge have passed from side to side, and have done much damage to the surface of both valves. For these specimens I am indebted to Mr. Robert Currie of Newcastle: those in *Perna*, from which the figures are taken, are in the Newcastle Museum.

C. cervina. Pl. XV. fig. 8.

Sponge formed of numerous branches, anastomosing, and enlarged into many rounded, and sometimes elongated lobes which are crowded upon each other, and measure each $\frac{1}{10}$ th of an inch wide: terminal branches or twigs rather stout, slightly tapering, bifurcating pretty regularly, and frequently with lateral branches giving to them not a little the appearance of antlers: papillæ

generally small, numerous, disposed with a good deal of regularity, and having a few very much larger than the rest intermingled; the larger ones $\frac{1}{24}$ th of an inch in diameter. Spicula of two forms; one $\frac{1}{100}$ th of an inch long, sometimes quite straight, but generally a little bent, particularly towards the end which is sharp-pointed; from thence it gradually enlarges to the other extremity; this terminates in a large, strongly defined, globular head, which is generally somewhat flattened like that of a pin; the shaft being mostly a little constricted at the point of union with the head. The other form of spiculum is only about $\frac{1}{4}$ th the length of the former, is irregularly tuberculated, and very stont and squat, bends rather suddenly in the centre, and tapers abruptly to the ends which are obtusely pointed.

This species is very like *C. spinosa* in general habit, but the terminal twigs are not so delicate, and are more regularly bifurcated: the lobes too are larger, and the papillæ less than they are in that species. The spicula are also very different, and are quite sufficient to remove all doubt if such existed.

Two or three specimens of *C. cervina* have occurred in the valves of *Meleagrina albina*? to which they have done much damage, and through the pellucid inner substance of which the sponge is distinctly revealed. These specimens are in the Newcastle Museum.

C. dendritica. Pl. XII. fig. 5. and Pl. XV. fig. 4.

Sponge minutely branched, slightly and irregularly anastomosing; the branches swelling at intervals into rounded or elongated lobes about $\frac{1}{24}$ th of an inch wide: terminal twigs frequently very long, and freely and elegantly divided like the branches of a tree: papillæ small, not numerous. Spicula not more than $\frac{1}{73}$ th of an inch long, proportionately stout, straight, occasionally a little bent; one end with a globular head, sometimes inclined to ovate, and tapering gradually to the other extremity, which is very finely pointed: there are likewise fusiform spicula; these are considerably smaller than those with heads, and bend suddenly in the centre; from thence they taper and terminate at each end in a sharp point.

Several individuals of this pretty species have been observed in a specimen of *Patella Mexicana* in the Newcastle Museum. These are clearly seen through the pellucid enamel of the inside of the shell, and have a very distinct dendritic appearance.

C. Canadensis. Pl. XIV. fig. 10.

Sponge composed of a dense anastomosing mass of strongly lobed branches; the lobes large in proportion to the central stem, but rarely exceeding $\frac{1}{16}$ th of an inch wide, somewhat rounded,

though irregular in form, and on account of their crowded state the mode of branching scarcely distinguishable, except towards the terminal twigs, which are linear, very minute and irregularly bifurcated: papillæ small, numerous, and passing through the surface of the matrix without apparent order, though pretty equally distributed and closely set; towards the margin of the sponge they occasionally run in lines. Spicula rather stout and short, being $\frac{1}{140}$ th of an inch in length, somewhat suddenly bent in the centre, with one end generally a little enlarged and rounded, the other tapering gradually to a sharp point. There is also another kind of spicula which appear to be more numerous than those just described, but not quite so long; these are sharply pointed at each end, and suddenly bent in the centre where they are thickest; at this point, too, there is frequently a decided nodule, and occasionally two or three.

Only one specimen of this species has been obtained; it is in the shell of *Ostrea Canadensis*. In general appearance this sponge has considerable resemblance to *C. lobata*; the lobes, however, are rounder and smaller, and the spicula at once distinguish it from that species, and from all others with which I am acquainted.

The puncturing in the sides of the excavations of *C. Canadensis* is minute and somewhat obscure, and less regular than usual.

C. millepunctata. Pl. XII. fig. 9.

Sponge composed of an intricate interlacement of minute branches not more than $\frac{1}{30}$ th of an inch thick, being throughout made up of close-set, irregularly rounded lobes, except towards their terminations, where they are linear and much less crowded: papillæ minute, close-set, and exceedingly numerous: spicula $\frac{1}{140}$ th of an inch long, linear, very slender, frequently much and abruptly bent in the centre, sometimes more gradually arched towards one end which is sharply pointed; the other termination is furnished with a large elliptical head.

I have seen only one example of this distinct species; it is in the shell of *Cassis tuberosa*, and spreads almost entirely over it; the surface is crowded with the minute papillary orifices, and on rubbing a little of it away the substance beneath is found to be completely riddled with the sponge, and to present a pretty regularly punctured appearance caused by the chambers occupied by the lobes. The principal branches, however, can be distinctly traced ramifying in various directions.

C. lobata. Pl. XII. figs. 4 & 8.

Sponge branched, anastomosing; the branches composed of a series of comparatively large, rounded, somewhat transversely

oval, and occasionally irregularly angulated lobes about $\frac{1}{12}$ th of an inch wide, and united by a small central stem: terminal twigs short, linear, and bifurcated: papillæ small, numerous, and distributed on the surface of the matrix without apparent order. Spicula $\frac{1}{100}$ th of an inch long, not very slender, mostly a little bent, and brought gradually to a sharp point at one end; the other with an irregularly rounded head, sometimes slightly elliptical, and generally not exactly terminal.

The puncturing of the chamber-walls of this species is strong and decided, and the branches in old specimens are much confused on account of the frequent anastomosis and the crowding caused by the lobes. Towards the terminal twigs the character of the branches is however quite distinct. The *C. lobata* is not to be confounded with any other of the British forms, and is undoubtedly distinct from the various foreign species that have come under my notice. It occurs in *Halotis* from Guernsey. I have seen two specimens affected by it, and in both cases very extensively; in one the whole external surface is crowded with the minute papillary punctures.

C. vastifica. Pl. XV. fig. 12.

Sponge formed of a close and intricate anastomosis of strongly lobed branches; lobes irregularly angulated, frequently $\frac{1}{8}$ th of an inch wide, and united by a delicate stem: terminal twigs not long, linear: papillæ small, rarely exceeding $\frac{1}{30}$ th of an inch in diameter, very numerous, close-set, and pretty regularly distributed over the surface of the matrix. Spicula of two kinds, one much larger than the other; the former $\frac{1}{8.7}$ th of an inch in length, straight, rather slender, and diminishing imperceptibly to a very fine point at one end; the other terminating in a perfectly globular head. The smaller kind of spiculum is about $\frac{1}{3}$ rd the length of the larger, and is much thinner; it is stoutish in the centre, where it rather suddenly bends a little, and from thence tapers gradually towards the ends, which are sharply pointed.

When the outer surface of the shell containing this species is removed, a complete close network of chambers is revealed, containing the lobes of the sponge; and on a closer examination they are seen to be united by small circular passages for the accommodation of the uniting stems. The only specimen I have seen of this species is in the shell of an oyster from Prestonpans?, the surface of which had suffered much injury by the influence of this parasite. The puncturing of the sides of the cavities of this species is finer than usual.

C. rhombea. Pl. XII. fig. 7.

Sponge when dry of a pale straw colour, composed of nume-

rous, small, imperfectly lozenge-shaped lobes, about $\frac{1}{16}$ th of an inch wide, crowded on each other and united each to its neighbours by small cylindrical stems, four or five passing from each lobe: terminal twigs short and linear: papillæ large in comparison with the lobes, measuring nearly $\frac{1}{25}$ th of an inch in diameter, rather numerous, and disposed on the surface of the matrix without order. Spicula of two forms, one much larger than the other, being upwards of $\frac{1}{87}$ th of an inch long, straight, stout, and generally tapering to a fine point at one end; the other termination is furnished with a globular head, a little inclined to oval. The other form of spiculum is not more than half as long as those with heads, but is only a little inferior in thickness: it is fusiform, tapering gradually to a sharp point at each end, and is abruptly bent in the centre.

This species occurs in *Tridacna gigas*; the lobes appear to be arranged in a somewhat branched manner, but on account of their close approximation the order is obliterated. Some of the uniting stems are larger than the rest, and most probably indicate the main branches.

C. purpurea. Pl. XII. fig. 6.

Sponge made up of numerous, close-set, somewhat elongated and angulated lobes or nodules about $\frac{1}{10}$ th of an inch in length, united by several delicate, cylindrical stems; and when dry of an obscure purple colour: terminal twigs short, linear: papillæ small, not very numerous, passing through the matrix without apparent order. Spicula numerous, of two sorts; one is larger than the other, $\frac{1}{100}$ th of an inch in length, linear, slightly and regularly bent, with the ends a little enlarged and rounded. The other kind of spiculum is about half as long as the preceding, and resembling it in form, with the exception that the extremities are not enlarged; it is likewise irregularly spinous throughout its entire length.

This species is readily distinguished by its purple colour and by the peculiar characters of its spicula. In general form there is considerable resemblance between it and *C. nodosa*; the lobes, however, are much smaller than they are in that species, and the stems that unite them are less numerous; they are likewise elongated. The *C. purpurea* occurs in *Tridacna gigas*.

C. angulata. Pl. XV. fig. 13.

Sponge formed of a few irregularly shaped and angulated lobes or nodules, sometimes measuring $\frac{1}{8}$ th of an inch wide, placed close together, and united by a few small, short, cylindrical or flattened stems: terminal twigs rather short, simple, small and linear: papillæ not very numerous, irregular in size and arrange-

ment, the largest about $\frac{1}{24}$ th of an inch in diameter. Spicula stout, nearly $\frac{1}{117}$ th of an inch long, slightly and regularly curved, gradually tapering to a sharp point at one end, and with an oval swelling at the other, but not quite terminal, and frequently ill-defined.

This species inhabits red coral from the Mediterranean, and completely destroys it; the interior being reduced to a few large irregularly angulated chambers divided by very thin walls, while the surface remains comparatively uninjured, showing no signs of the ravages within except a few circular punctures of no great size, and at first so small as scarcely to attract attention. The puncturing of the walls of the chambers is very strong and regular in this species, and the spicula are characteristic, and stouter than usual: the stems that unite the lobes are comparatively few.

C. quadrata. Pl. XV. fig. 6.

Sponge composed of large, irregularly quadrate lobes, $\frac{1}{6}$ th of an inch wide, with the angles obtuse, connected without apparent order by several small, cylindrical stems passing irregularly from all sides, occasionally in pairs; sometimes enlarged and flattened and arising from a depression in the side of the lobe: terminal twigs rather short, fine and linear: papillæ not very numerous, about $\frac{1}{24}$ th of an inch in diameter, and placed rather far apart. Spicula very large and stout, measuring $\frac{1}{70}$ th of an inch in length, in form somewhat resembling a nine-pin; the shaft fusiform, swelling in the centre to an extraordinary degree, and tapering gradually to a fine point at one end; the other terminates in an exactly rounded head, very large, and distinguished from the shaft by a dusky shadow caused by its rotundity.

The animal of this species when dry is of a dark brown colour, and may at once be recognized by the enormous development of the spicula, which possess the utmost brilliancy, and are very striking objects in the microscope. The excavations are also characteristic; their squareness of form, and numerous orifices for the passage of the connecting stems arranged frequently in pairs and flattened, sufficiently distinguish this species. Only one or two individuals have occurred, and those in *Tridacna gigas*.

C. nodosa. Pl. XV. fig. 10.

Sponge formed of a congeries of large, irregularly angulated lobes disposed without apparent order, each measuring $\frac{1}{6}$ th of an inch wide, and united to each other by several delicate, very short, cylindrical stems: terminal twigs slender, a little produced, cylindrical: papillæ not numerous, considerably apart from each other, the largest about $\frac{1}{24}$ th of an inch in diameter. Spicula

stout, fusiform, $\frac{1}{1\frac{1}{3}}$ th of an inch long, much bent in the centre, and tapering towards the ends, which are sharp-pointed.

The animal of this species when dry is snuff-coloured, and is readily distinguished from its congeners by its simple-formed spicula. When the shell in which it is concealed is broken across, the numerous, large, angulated chambers containing the lobes, separated only by thin walls, have much the appearance of honey-comb, lacking a little of its symmetry and perfect angularity. The *C. nodosa* is one of several species found in a large specimen of *Tridacna gigas*, and is evidently very destructive; large portions of the strong ribs of the shell having given way in several places under the influence of this parasite.

C. labyrinthica. Pl. XV. fig. 7.

Sponge composed of an irregularly reticulated mass, the interlacing being exceedingly minute, and so intricate that it is impossible to determine the order of the parts: papillæ not very numerous, minute, without apparent order. Spicula numerous, fusiform, $\frac{1}{2\frac{1}{3}}$ rd of an inch long, rather stout, nearly cylindrical, slightly and regularly bent from end to end, with each termination suddenly brought to a sharp point.

When dried this species is of a pale straw colour: it occurs in *Tridacna gigas*, to the shell of which it is very destructive. Several specimens have occurred; one of them has sunk upwards of an inch deep into one of the ribs of the shell, and has extended its ravages four or five inches in length and nearly two in breadth, passing, in fact, from side to side of the rib, and giving to the entire substance the appearance of the central cellular structure of bone; and this resemblance is rendered the more perfect on account of a thin layer of the surface being left almost sound.

Genus THOOSA*.

Sponge branched or lobed, buried in calcareous bodies; the interior with anastomosing tubes, and devoid of spicula; the surface with a crust of nodulous, crystalline bodies composed of siliceous bodies.

This genus by its general form and habit is closely related to *Cliona*, from which it differs chiefly in the character of the siliceous bodies on the surface, and in the absence of spicula from the interior. Two or three species have occurred; they are all from the tropics, and vary considerably in form; one or two of them have radiating spicula mixed with the siliceous bodies of the surface.

T. cactoides. Pl. XIII. figs. 1 & 2.

Sponge branched, strongly lobed, regularly and widely ana-

* A sea-nymph.

stomosing; the meshes frequently more than $\frac{1}{4}$ th of an inch wide; lobes elliptical, about $\frac{1}{2}$ th of an inch broad, and giving off numerous, minute, linear twigs: terminal branches dividing dichotomously and furnished on all sides with twigs similar to those of the lobes: the dichotomous arrangement may be traced throughout the branches. Siliceous bodies of the surface very numerous, measuring $\frac{1}{17\frac{1}{2}}$ th of an inch long and $\frac{1}{23\frac{1}{4}}$ th of an inch broad, composed of two whorls, each comprising six or seven squarish nodules; the whorls being placed a little apart from each other near the ends of a stout central axis which terminates at each extremity in a nodule like those of the whorls.

This is one of the largest and most beautiful of the excavating sponges; only one individual has occurred: it is buried in the substance of a large valve of *Meleagrina margaritifera* which has been in my collection many years. The branches extend from side to side of the shell, and reach from the beak almost to the ventral margin, measuring in length six or seven inches. The outer surface of this valve has unfortunately been removed, and the papillary punctures consequently destroyed: the ramifications of the lobed branches, however, are completely exposed, so that they can be traced throughout. But a considerable number of the terminal twigs remain imbedded in the shell, and are distinctly seen through the inner transparent layer.

The puncturing of the walls of the cavities of this species is so strong that it may be seen even with the naked eye; and they are likewise penetrated with numerous small orifices for the passage of the minute twigs which come from the underside of the lobes. Whether similar twigs pass from the upper surface I have not been able to determine, on account of the destruction of the external portion of the shell. Those from the lower surface puncture the innermost layer of the valve; and as pearly matter has accumulated around each orifice, the inside of the shell is ornamented with numerous clusters, corresponding to the lobes, of minute pearl-like points, the beauty of which has probably led to the preservation of the shell.

T. bulbosa. Pl. XII. fig. 10.

Sponge composed of a few large, irregularly shaped, and somewhat depressed lobes, occasionally inclining to square, but always more or less rounded; united by a slender stem mostly flattened and variable in form: papillæ not large, few, penetrating the surface of the matrix without order; apparently not more than one or two from each lobe. Siliceous bodies of the surface like those of *T. cactoides*, but a little less. In addition to these bodies the surface is provided with triradiate and quadriradiate spicula, the rays, measuring $\frac{1}{29\frac{1}{3}}$ rd of an inch long, are straight, diverge

at various angles, and each tapers gradually to a fine point ; at the place of junction there is generally a slight swelling.

Several individuals of this species are buried in the specimen of *Tridacna gigas* so often mentioned. In some of them the lobes attain a great size, measuring half an inch in diameter. The walls of the chambers are much more minutely punctured than in *T. cactoides* ; and in one of the specimens examined the spicula differ from those above described. In the specimen alluded to they are multiradiate and triradiate of a peculiar character, the latter, Pl. XIII. fig. 8, having one of its rays cut short—little more than a squarish tubercle indicating the point of union : the other two rays bend from each other rather abruptly near the middle and afterwards taper gradually to fine points. The multiradiate spicula, Pl. XII. fig. 11, are about three times the length of the nodulous bodies, and are rare and very complicated : they are formed of two whorls of six or more rays each, the whorls being placed rather near together on a central axis which is much produced at the ends ; the rays are straight, and, tapering gradually to sharp points, have generally a rounded swelling near the extremity.

I have not yet been able to determine whether the specimen provided with these curious spicula is distinct or not, though I am inclined to believe that it is.

EXPLANATION OF PLATES XII. XIII. XIV. AND XV.

PLATE XII.

- Fig. 1.* A portion of the surface of *Cliona celata* as seen in the compressor, magnified about 400 diameters, exhibiting crystalline bodies.
- 2. Large crystalline bodies from the same more highly magnified.
 - 3. Small crystalline bodies also from the same, highly magnified.
 - 4. Chambers of *C. lobata* exposed by removing the surface of the matrix :—one half larger than nature :—*a*, papillary punctures.
 - 5, 5. Portions of *C. dendritica* four or five times the size of nature, exhibited as seen through the transparent substance of the matrix.
 - 6, 6. Spicula of *C. purpurea* much enlarged : *a*, a spiculum still more highly magnified.
 - 7, 7. Spicula of *C. rhombea* much enlarged.
 - 8. Ditto *C. lobata* ditto.
 - 9. Ditto *C. millepunctata* ditto.
 - 10. *a*, Crystalline nodulous bodies from the surface of *Thoosa bulbosa* ; *b*, triradiate and quadriradiate spicula from the same.
 - 11. Multiradiate spicula from the surface of *Thoosa bulbosa* ? : *a*, an end view of a spiculum ; *b*, one of the rays more highly magnified.

PLATE XIII.

- Fig. 1.* A portion of the branches and terminal twigs of *Thoosa cactoides* of the natural size.
- 2. *a*, A portion of the surface of the same magnified about 200 diameters, exhibiting nodulous crystalline bodies ; *b*, two of these bodies more highly magnified.

- Fig. 3. The branched chambers of *Cliona celata* exposed by the removal of the surface of the matrix : *a*, papillary punctures.
- 4. Spicula of *C. celata* much enlarged.
 - 5. *C. spinosa* as seen through the transparent matrix, magnified two times.
 - 6. A portion of the surface of the matrix exhibiting the papillary punctures :—natural size.
 - 7. Spicula of *C. spinosa* much enlarged.
 - 8. Triradiate spicula from the surface of *Thoosa bulbosa*?

PLATE XIV.

- Fig. 1. Chambers of *C. gorgonioides* exposed by the removal of the surface of the matrix, a little enlarged : *a*, papillary punctures.
- 2. *C. Fryeri* as seen through the transparent matrix; one half enlarged.
 - 3. Surface of the matrix of the same, exhibiting the papillary punctures.
 - 4. A series exhibiting the development of *C. Fryeri* considerably enlarged : *a*, represents the first stage; *b*, *c*, *d*, *e*, *f*, the succeeding stages.
 - 5. Spicula of *C. Northumbrica* much enlarged.
 - 6. Ditto *C. gorgonioides* ditto.
 - 7. Ditto *C. gracilis* ditto.
 - 8. Ditto *C. Howsei* ditto.
 - 9. Ditto *C. Fryeri* ditto.
 - 10. Ditto *C. Canadensis* ditto.

PLATE XV.

- Fig. 1. Chambers of *C. corallinoides* exposed by the removal of the surface of the matrix : *a*, papillary punctures.
- 2. Spicula of *C. corallinoides* much enlarged.
 - 3. Ditto *C. radiata* ditto.
 - 4. Ditto *C. dendritica* ditto.
 - 5. Ditto *C. insidiosa* ditto.
 - 6. Ditto *C. quadrata* ditto.
 - 7. Ditto *C. labyrinthica* ditto.
 - 8. Ditto *C. cervina* ditto.
 - 9. Ditto *C. Alderi* ditto.
 - 10. Ditto *C. nodosa* ditto.
 - 11. Ditto *C. muscoides* ditto.
 - 12. Ditto *C. vastifica* ditto.
 - 13. Ditto *C. angulata* ditto.

XXXVII.—On the Mode of Growth in Calothrix and allied Genera. By JOHN RALFS, M.R.C.S., Penzance*.

IN my former communication I remarked that in *Oscillatoria* the division of the filament is accompanied by that of its sheath, whilst in *Microcoleus* the sheath is so inflated as not to interfere with the process of division. I shall now endeavour to prove that the appositional branches in *Calothrix* and other genera are the results of modifications of that mode of division which we see in *Oscillatoria* and *Microcoleus*.

* Read before the Botanical Society of Edinburgh, 8th March, 1849.

In *Scytonema*, *Calothrix*, *Arthronema*, &c. the sheath is somewhat cartilaginous and closely surrounds the contained filament. As its texture is comparatively firm, it admits only a slight degree of dilatation: it neither separates as in *Oscillatoria*, nor allows the bundling of the filaments as in *Microcoleus*.

In all these genera the structure of the filament, irrespective of the sheath, is alike, and consists of a single, longitudinal series of disciform cells which are often confluent or have indistinct dissepiments.

If a specimen of *Calothrix* or *Cænocoleus* be examined we may frequently observe, especially near the extremities of the branches, short separated portions of filaments in every respect similar to those which sometimes occur in *Oscillatoria*. At first such a portion is separated from the original filament by a short interval; but as there is no division of the sheath and both portions continue to elongate, they are soon in contact again. In the act of passing each other the extremities sometimes become attenuated. In this state the filament looks as if it had divided obliquely, and the upper portion becoming impacted between the filament and the sheath presents the appearance of a branch. From this explanation it will be evident that the branches in these genera are produced, not by an adhesion of other filaments, but by a dislocation of the filament itself.

Both portions continue to elongate upwards, and branches are thus repeatedly formed by dislocation. The upper portions or branches, however, always retain their original advantage and extend beyond the trunk. This fact seems to me a strong proof of the correctness of the view I have given, for it could scarcely be constant if the branches originated in any other manner.

The frond or sheath is itself truly branched or divided in the ordinary way. Sometimes, as in *Calothrix*, it is forked as soon as the upper portion becomes impacted, and the plant presents no peculiarity to the eye in its mode of branching except that the branches at the base are not united to the trunk.

In *Cænocoleus* the branching of the sheath does not occur at the same spot as the dislocation of the filament. Upon this circumstance depends the peculiar character of the genus, for after the dislocation the inferior portion as it elongates necessarily pushes itself up by the side of the superior one. Sometimes the filaments are again branched by dislocation before the sheath divides, and thus from two to four (or even more) filaments pass up side by side within a common sheath. Where the sheath forks the filaments are in general equally distributed between its branches.

From what I have stated it will be seen that in *Calothrix* and *Cænocoleus* the dislocated ends pass each other without any

alteration of their direction. This is not the case in *Scytonema myochrous*, which acquires a very different habit owing to the variation in the direction of the dislocated extremities. In that plant the new ends are curved towards the same side of the sheath; they do not pass each other, but issue from the side together and at right angles to its axis. As both portions encounter equal resistance they elongate equally, and consequently the branches are said to be in pairs. Sometimes the dislocation does not take place until after a loop has been formed by a lateral protrusion. Occasionally also the dislocation occurs without any curvature of the newly formed ends, which then pass each other as they do in *Calothrix*; but this rarely happens except in the case of lower or basal dislocations. The presence in the same specimen of both modes of branching proves that they depend on modifications of the same law, notwithstanding their very different appearance.

Calothrix mirabilis presents another variation in the direction of the dislocated ends. At first sight the mode of branching appears similar to that of *Scytonema myochrous*, and different only in having more frequent divisions; but closer examination detects an essential difference. The filament indeed separates as in *Calothrix* and the ends pass each other; but instead of remaining within the same sheath, they immediately pass out obliquely in opposite directions; consequently as both portions are free and continue to elongate, they seem merely to anastomose by cohesion at the convexities of their sheaths. As this plant divides at short intervals, it has the appearance of intricate network.

In *Rivularia* also the branches are the result of dislocation, but in that genus a globule is formed at the base of the branch at the time of dislocation.

A similar globule is present in the lower branches of some species of *Calothrix* and *Cænocoleus*; in these however it is usually developed only after the impaction of the branch, but sometimes during the division of the filament. If the lower portion of the filament elongates and passes the vesicle, its appearance does not differ from one formed after dislocation. If the lower portion ceases to grow at the time of division, the plant is like a simple filament here and there interrupted by a vesicle or sporangium.

In this group, however, the branching of the filament is not invariably accompanied by dislocation: in *Stigonema* I believe it never occurs, and even in *Scytonema* I have seen some species allied to *myochrous* in which the branches were apparently produced in the usual manner by lateral protrusion without interruption of continuity.

XXXVIII.—*Additions to the Fauna of Ireland*. By WILLIAM THOMPSON, Esq., Pres. Nat. Hist. and Phil. Society of Belfast.

BIRDS*.

1. Kentish Plover, *Charadrius Cantianus*, Latham.

Three were killed in August last in Belfast bay. I subsequently learned from Robert J. Montgomery, Esq. that two were shot in Dublin bay in the autumn of 1846; one of which, procured by that gentleman, was kindly sent from Dublin for my inspection.

2. Temminck's Stint, *Tringa Temminckii*, Leisler.

A bird of this species, as I am informed by R. Chute, Esq., was shot near Tralee at the end of January 1848.

MOLLUSCA.

1. *Bullæa pruinosa*, Clark.

A dead specimen was obtained by George Barlee, Esq., by dredging on gravelly mud in Birterbuy bay in May 1848, at a depth of from twelve to fifteen fathoms.

2. "*Bulla?* *acuminata*, Brug. not Sow.," Philippi, Moll. Siciliæ, v. i. 122. t. 7. f. 18.

Procured with the last, and also at Arran off Galway bay, at a similar depth by Mr. Barlee. About the same time (May 1848) Mr. MacAndrew's dredge brought up a dead specimen between Penzance and the Old Head of Kinsale. He also took the species in sixty fathoms water on sandy mud, about fifteen miles off Mizzen Head (the nearest land), and in Bantry bay.

3. *Bulla mammillata*, Phil. Moll. Siciliæ, v. i. 122. t. 7. f. 20.

Procured on the coast of Galway in 1848 by Mr. Barlee.

4. *Orbis foliaceus*, Phil.

A specimen was brought up at the same time with the last off Mizzen Head.

5. *Stylifer Turtoni*, Brod.

Mr. Jeffreys informs me that his collection contains a specimen of this shell from Dublin bay.

6. *Rissoa abyssicola*, Forbes.

Procured at the same depth and on the same ground as *Bulla acuminata* off Mizzen Head.

7. *Rissoa fulgida*, Mont. (sp.).

Taken about the roots of sea-weed at low-water, Birterbuy bay, by Mr. Barlee.

* *Correction*.—For *Porphyrio hyacinthinus*, noticed in the 'Annals,' vol. xviii. p. 311, read *Gallinula martinica*, Gmelin, of which species, Mr. R. Chute writes to me, he has now ascertained his specimen to be.

8. "*Eulima nitida* (*Melania*), Lam.," Phil. Moll. Siciliæ, vol. i. p. 157. t. 9. f. 17, and vol. ii. p. 134.

Obtained by Mr. Barlee on the coast of Galway in 1848; according to a communication received from Mr. Jeffreys.

9. *Fusus Sabini*, Gray. See Alder's Moll. Northumb. p. 64.

Mr. Jeffreys possesses this species from Dublin bay.

10. *Trichotropis borealis*, Brod. and Sow.

A specimen was found among a quantity of old and worn bivalve shells, dredged from twenty-five to thirty-five fathoms outside the entrance of Belfast bay in July 1848, and sent to me by Mr. Hyndman. Mr. Barlee obtained the species in the summer of this year on the coast of Galway.

11. *Natica sordida*, Lam.

From Dublin bay, in Mr. Jeffreys's cabinet. Dredged off Dingle bay and Baltimore harbour by Mr. MacAndrew.

12. *Chiton Hanleyi*, Bean; Thorpe, Marine Conch. p. 263. f. 57.

Dredged off Arran islands, co. Galway, by Mr. Barlee in 1848:—Mr. Jeffreys.

13. *Ervilia castanea*, Mont. (sp.), Forb. and Hanl. Brit. Moll. vol. i. p. 341. t. 31. f. 5, 6.

Procured with the valves united on the coast of Galway by Mr. Barlee in 1848. All previous specimens obtained on the British coast (off Cornwall and the Scilly islands) were but single valves, according to the work particularly referred to for this species.

14. *Nucula Polii*, Phil.

Mr. MacAndrew informs me that he dredged "some very young shells in May 1848 near the Nymph Bank at from fifty to sixty fathoms, and about as many miles from the Old Head of Kinsale on the course from the Land's End. In June, similar specimens were dredged from forty fathoms between Mizzen Head and Cape Clear, about twenty miles off the land."

15. *Galeomma Turtoni*, Sow.

An imperfect valve was dredged from the Nymph Bank by Mr. MacAndrew in 1848.

16. *Ascidia virginea*, Forb. and Hanl. Brit. Moll. vol. i. p. 33. pl. C. f. 2.

I have observed a few individuals of this species on the north-east coast. I doubt its identity with the *A. virginea*, Müll. Zool. Dan. vol. ii. p. 12. t. 49. f. 4, to which it is referred in the work quoted.

17. *Aplidium fallax*, Johnst. in Loud. Mag. Nat. Hist. vii. 15. f. 4.

Found by me on the north-east coast several years since.

18. *Botrylloides rubrum*, M.-Edw. Mem. Ascid. Comp. p. 88. pl. 6. f. 3; Forb. and Hanl. Brit. Moll. vol. i. p. 24.

From the middle of February last, and during spring, this handsome species was commonly thrown ashore at Cultra, Belfast bay, its bright colour often rendering it quite a conspicuous object among the ordinary rejectamenta of the waves. Its attachment to plants which grow within a few fathoms of depth denoted its being an inhabitant of comparatively shallow water. The largest mass which came under my notice (brought to me by Mr. Wm. Patterson) was $4\frac{3}{4}$ inches in length, $1\frac{1}{2}$ inch in breadth, and $\frac{1}{3}$ inch in thickness at the thickest portion; weight $\frac{3}{4}$ of an ounce. It was adherent to several of the narrow leaves of *Zostera marina*, which are about $\frac{1}{8}$ of an inch in breadth, and to these only. The gelatinous mass was reddish brown; the systems of animals of a brilliant orange-red. It agreed in all respects with the description and figure of M.-Edwards. The variety in the ramification of the systems of animals through so large a mass was extremely beautiful, resembling an elegant pattern done in lace-work.

A plant of *Halidrys siliquosa* dredged from five fathoms in Belfast bay on the 3rd of April (kindly sent to me by Edmund Getty, Esq.) contained several masses of *Botrylloides*. They were all of a very pale grayish gelatinous colour; the systems of animals in some, more irregularly disposed than in *B. rotifera*, as figured by M.-Edwards, were whitish; others disposed like *B. rotifera* were buff; others again disposed precisely like *B. rubrum* were orange. Some tadpole-like larvæ as figured by M.-Edwards (pl. 4) were observed.

B. rubrum has hitherto been recorded as found on the coast of Normandy (M.-Edwards) and at Falmouth (Alder) only*.

I cannot leave the subject of Mollusca without acknowledging the great kindness and liberality of Mr. MacAndrew and Mr. Barlee, who have this year, as well as on former occasions, when dredging on the coast of Ireland, hastened to supply me with lists of the rare species obtained, together with other interesting matter on the subject. To Mr. Jeffreys also I am indebted for a list of the rare Irish species in his unrivalled collection of British Mollusca.

CRUSTACEA.

1. *Hippolyte pandaliformis*, Bell.

On examining two specimens of an *Hippolyte* some months since, which had been dredged in Belfast bay, I could not identify them

* *Botrylloides albicans*, M.-Edw. Observ. Ascid. Compos. p. 88. t. 6. f. 2; Forb. and Hanl. Brit. Moll. vol. i. p. 24. t. A. f. 8.

As in the work last quoted this species is noticed as British only from my record of its being obtained on the coast of Down (on that of Normandy alone it had previously attracted attention), I may here state, that in the month of January last, I observed it on various species of *Fuci* on the shore of the island of Islay, Scotland. It was remarkably fine on the broad leaves of *Fucus serratus*, which there attain 4 inches in breadth. On these, this *Botrylloides* formed large masses $3\frac{1}{2}$ inches in diameter, and was very beautiful, owing to the ramifications of the series of animals of a whitish hue, faintly tinged with pink, through the dull coloured gelatinous mass.

with any described species. They were submitted to Professor Bell for the use of his work on the British Crustacea, and proved to be of a species that he considered new, and of which he had just drawn up a description under the name of *H. pandaliformis*. "This name" (he observed) "suggested itself from their leading to the typical Palæmons through *Pandalus*;" a peculiarity of structure which had also attracted my attention.

2. *Idotea acuminatum*, Leach ?

Among Crustacea kindly sent from Dublin for my inspection by R. Ball, Esq. were two individuals of an *Idotea* 10 lines in length, very distinct in form from our three common species, the *I. pelagica*, *I. entomon* and *I. æstrum* of Leach. They were purchased of Mr. M'Calla, but on what part of the coast taken was not stated. I mark the species with doubt on account of Leach's only specimen in the British Museum, with which they were compared, being in a bad state of preservation. The *I. acuminatum* was first noticed in the British Museum catalogue of Crustacea, p. 95 (published in 1847), as among Dr. Leach's inedited species. He obtained it on the coast of Devon, and called it in his *MS.*, *Leptosoma lancifer*.

3. *Caligus Nordmanni*, Edw. Hist. Crust. vol. iii. p. 455; and Atlas, Cuv. Règ. Anim. pl. 77. f. 1.

I took several specimens of this fine *Caligus* alive on a sun-fish (*Orthogoriscus mola*) captured on the coast of Antrim in September 1848. They were all adherent externally to the skin of the fish on different parts of the body. When living they were marbled over with grayish lilac of dark and light shades. This species was erroneously included in a paper published in the 20th vol. of the 'Annals,' p. 248. The name *C. Mulleri* being substituted there for *C. Nordmanni* will make all correct. Two others noticed in the same page require the following correction, according to Dr. Baird, who then kindly assisted in determining them, but has since given the subject a more rigid examination.

Caligus vespa should be *Cal. Stromii*, a species since described by Dr. Baird in the Report of the Berwickshire Naturalists' Club for 1847, p. 259*.

Caligus sturionis should be *Cal. rapax*, Edw. Hist. Crust. vol. iii. p. 453. pl. 38. f. 9.

ANNELIDA.

1. *Planaria flexilis*, Dalyell, Observ. on Planariæ, p. 5. f. 1, 2.

April 14, 1848. I found at Cultra, Belfast bay, two *Planariæ* of this species adherent to the under side of a stone between tide-marks, and brought them home in sea-water to be observed at leisure. When fully extended they are 6 lines long, and at the head $2\frac{1}{2}$ broad, becoming thence gradually narrower. Eyes commencing at the distance of a line from the anterior extremity of the body; all extremely minute, but differing in size; disposed irregularly in a somewhat crescentic form on either side a transparent circle. The vessels along

* [See also Annals, vol. i. Ser. 2. p. 396.]

the centre of the body are prettily ramified like those of the genus *Glossiphonia*, as represented by Moquin-Tandon (Monog. Hirudinées, pl. 14, 2nd edit.). Outside this central distribution of vessels, the body to very near the margin is most minutely and beautifully ramified all over:—the whole worm presenting the appearance of a *Glossiphonia* “set”—in jewellers’ language—in the centre of a *Planaria*, which broadly expands on every side. This appearance is literally “shadowed forth,” in Sir J. Dalyell’s figure 2. The colour of one of my specimens which lived in a phial of sea-water, changed about once in thirty-six hours, for twelve days, was during the time transparent, with the central *Glossiphonia*-like vessels whitish; the ramifications outside them reddish lilac.

The motion of these *Planariæ* is “very rapid, smooth, continuous and even,” as Dr. Johnston describes that of the *Plan. subauriculata* to be (Loudon’s Mag. Nat. Hist. ix. 16. f. 2), and with which species I cannot but consider the *P. flexilis* identical. The differences set forth in Dr. Johnston’s diagnostic characters of the two, are, that the body of *P. flexilis* is “semicircular in front,” that of the other “obtuse;” and, that the intervening space between the eyes is like the rest of the body in *P. flexilis*, but, that “a clear circular spot to each of the two clusters of eyes” exists in *P. subauriculata*. The individuals examined by me are occasionally obtuse, and occasionally semicircular in front, and present themselves exactly of the forms represented by both authors, as well as in innumerable other shapes. The position of the eyes is the same in both the supposed species; the “clear circular spot” to each cluster may either have escaped being recorded by Sir J. Dalyell, or possibly may not have existed in his specimens;—mine have both clusters of eyes within *one* transparent circle. On full consideration of the descriptions and figures of *P. flexilis*, Dalyell, and *P. subauriculata*, Johnston, I cannot—although it is opposing my ignorance to Dr. Johnston’s knowledge of the subject—believe the species to be distinct. My specimens agree about equally well with both species*. Further, it may be remarked that my specimens have presented the form of *Polycelis pallidus*, Quatrefages (Ann. Sci. Nat. tome iv. pl. 3. f. 8—1845), to which they seem nearly allied: the eyes are just as represented in the highly magnified fig. 9 of that species. It was obtained by M. Quatrefages on many parts of the coast of Sicily. The *P. flexilis* was procured in the Firth of Forth, and *P. subauriculata* in Berwick bay.

2. *Euphrosina foliosa*, Aud. & Edw. Hist. Nat. du Littoral de la France (Annelides), p. 126. pl. 9. f. 1–4.

Aug. 26, 1844. A very handsome Aphrodite-looking species †,

* Having written my friend Dr. Johnston on this subject and requested his opinion, he replied:—“On a re-examination of the two *Planariæ* I find the distinction attempted to be made between them too fine and uncertain, so that I am forced to agree with you in the propriety of uniting them in one species.”

† It is not however of the family *Aphrodisiens*, but of the *Amphinomiens*

dredged today by Mr. Hyndman off Castle Chichester, Belfast bay, was brought to me. It was taken about a mile from the shore on shelly ground in from six to ten fathoms water. Being soon after capture sent to Dr. Johnston, it proved as new to him as to myself, and was left at Berwick for him to notice until lately, when in consequence of his having ceased to study the Annelides it was returned to me. Professor Allman then kindly undertook its examination and determined it to be this *Euphrosina*. The specimen is an inch in length; the size attributed to the species by M.-Edwards. Two others differing only in being smaller were last year purchased by Mr. R. Ball (of M'Calla), but it was not stated on what part of the coast they were procured. This is the first record of the genus *Euphrosina* inhabiting the British seas. M.-Edwards's specimens were taken on oyster-banks in the two neighbouring localities of St. Malo and between Granville and Chausey; in the latter locality, a league and a half from the shore, and at the depth of fifteen fathoms.

"*Octobothrium* (?) *Merlangi*,
(*Octostoma Merlangi*, Kuhn.)," Nordmann, Mikrogr. Biet. p. 78.
pl. 7.

Specimens of this parasite were found attached to the gills of whiting (*Gadus Merlangus*) in April; to those of the hake (*Gadus Merluccius*) in May; and to those of the pollack (*Gadus Pollachius*) in October 1837, by Dr. Bellingham of Dublin, in the market of which city the fish were purchased. The specimens are mostly about 4 lines in length. The genus has not before been noticed as found in the British seas.

ZOOPHYTES.

1. *Gorgonia verrucosa*, Linn., Johnst. Brit. Zooph.

The first *Gorgonia* of any species which I have seen from the coast of Ireland, was a portion of *G. verrucosa* sent to me in March last by Mr. R. Ball. The specimen was procured at the island of Lambay, off the Dublin coast, and taken to Mr. Warren by the man who found it on account of the size (18 inches from base to extremity of branches), he having never seen any so large before*.

of Aud. and Edw. Along with the *Euphrosina*, a singular new species, of which Dr. Johnston constituted the genus *Spinther* (*S. oniscoides*), was taken; it is included in the former family.

* This has been erroneously called *Gorgonia flabellum* in the published list of donations to the Dublin University Museum, Dec. 1848, p. 8. A specimen of *G. flabellum* with the root attached was brought up in a trawl-net from eight to ten fathoms depth off Bangor, Belfast bay, last summer, by Mr. Hyndman, who judiciously considered it a foreign specimen. That it had for some time been a denizen of our seas was however evident from the native productions which were attached, such as *Crisia eburnea*, *Cellularia ciliata*; *Grantia compressa* and *G. ciliata*; *Serpula triquetra*, with small portions of *Conferve* and other native Algæ. This *Gorgonia* was 14 inches in height and the same in breadth.

2. *Alecto major*, Johnst. Brit. Zooph. p. 281, 2nd edit.

Adherent to old bivalve shells dredged outside the entrance of Belfast bay, from the depth of twenty-five to thirty-five fathoms, in July 1848, and sent to me by Mr. Hyndman.

3. *Alecto dilatans*, Johnst. Brit. Zooph. p. 281.

With last. I had previously noted this species or *form*—for I do not feel altogether satisfied respecting the specific distinctness of *A. major* and *A. dilatans*—as observed with other deep-water zoophytes on a stone dredged from forty fathoms off Whitehead, county of Antrim. Its three branches render this specimen more elegant than any of those figured by Johnston.

4. *Lepralia simplex*, Johnst. B. Z. p. 305.

I find this very fine and well-marked species on old bivalve shells, *Modiola vulgaris*, *Pecten opercularis*, &c., dredged on the same occasion as *Alecto major*.

5. *Lepralia Hyndmanni*, Johnst. ? B. Z. p. 306.

As last. Marked with doubt on account of the specimens being much worn.

6. *Lepralia annulata*, Fabr. (sp.), Johnst. B. Z. p. 313.

As last.

7. *Lepralia Peachii*, Johnst. B. Z. p. 315.

As last.

8. *Lepralia innominata*, var. ? Couch (description, *not* figure), Johnst. B. Z. p. 319.

As last.

9. *Lepralia Ballii*, Johnst. B. Z. p. 321.

As last. A very distinct species.

10. *Lepralia trispinosa*, Johnst. ?

As last. Agreeing with the description (Brit. Zooph. p. 324, 2nd edit.) better than with the figure, in the aperture being "small and circular," &c.

11. *Lepralia coccinea*, Abilgaard in Müll. Zool. Dan. vol. iv. p. 30. t. 146. f. 1, 2 ; Johnst. Brit. Zooph. p. 322. pl. 57. f. 2, 3, 2nd edit.

Adherent to a stone dredged from five fathoms at Donaghadee in Aug. 1848. This species is distinct from the *L. coccinea* of the 1st edit. British Zoophytes, and is called *L. unicornis* in the 2nd edit. I notice it here, as the variety β . only (*L. appensa*), is recognized as Irish in the last-named work.

XXXIX.—*The Musci and Hepaticæ of the Pyrenees.*

By RICHARD SPRUCE.

[Continued from p. 293.]

Hemicyclum 2. *Acrocarpi.*

Tribus 9. BARTRAMIACEÆ, Bryol. Europ.

16. *Bartramia*, Hedwig.

§ 1. (= BARTRAMIA, Bridel.)

117. *B. stricta*, Brid. Mant. Musc. p. 116; Br. Europ. *Bartramia*, t. 1.

Hab. P. or. "in Pyrenæis et Monte serrato Hispaniæ, anno 1803" (Bridel, Br. Univ. 2. p. 45); *Concampa*, etiam *au montant de Boulon à Bellegarde* (Arnott!).

118. *B. gracilis*, Floerke in Schrad. Bot. Journ. 1799; M. P. 100. *B. Oederi*, Swartz; Br. Europ. l. c. t. 3.

Hab. Z₁₋₂ in rupibus umbrosis, haud infrequens.

119. *B. ithyphylla*, Brid. Mant. Musc. p. 116; Br. Europ. l. c. t. 2; M. P. 101.

Hab. Z₂₋₅ in rupibus graniticis terra obtectis.

120. *B. pomiformis*, Hedw. Sp. Musc. p. 164; Brid. Europ. l. c. t. 4; M. P. 102.

Hab. Z₁₋₃ in umbrosis, terrestris et rupestris.

Var. *crispa*, M. P. 103. *Bartramia crispa*, Sw. Musc. Suec. p. 73. *Hab.* in rupestribus præcipue subalpinis.

121. *B. Halleriana*, Hedw. Musc. Frond. 2. t. 40; Br. Europ. l. c. t. 5; M. P. 104.

Hab. Z₂₋₃ ad rupes in regione sylvatica superiore.

§ 2. (= PHILONOTIS, Bridel.)

122. *B. calcarea*, B. et S.! Br. Europ. l. c. p. 19. t. 10; M. P. 105.

Hab. Z₁₋₃ P. occ. et c. in solo calcareo secus ripas rivulorum vel in scaturiginosis calcareis. *Gélos*; *Gave de Combascou*, &c. *Tourmalet* et *Cirque d'Arbizon* (Philippe!).

123. *B. fontana*, L. Sp. Pl. p. 1574 (sub *Mnio*); Br. Europ. t. 9; M. P. 106.

Hab. Z₀₋₄ in humidis.

124. *B. marchica*, Hedw. Musc. Frond. 2. t. 39 (sub *Mnio*); Br. Europ. l. c. t. 8.

Hab. Z₁₋₂ P. occ. *Vallée de Béost*, sterilis; P. c. *B.-de-Bigorre*, sur la route de Toulouse, fertilis (Philippe!).

Tribus 10. OREADEÆ, Br. Europ.

17. *Catoscopium*, Bridel.

125. *C. nigratum*, Dicks. Cr. Fasc. 3. p. 9 (sub *Bryo*); Br. Europ. *Catoscop.* (cum icone); M. P. 99.

Hab. Z₂ P. occ. *Mont Lizé*, in paludosis secus rivulos.

Tribus 11. GEORGIACEÆ.

(*Tetraphideæ*, Br. Europ.)

18. *Georgia*, Ehrh. Hann. Magaz. 1780, p. 931.

(*Tetraphis*, Hedw. Fund. Musc. 2. p. 87.)

126. *G. pellucida*, L. Sp. Pl. p. 1574 (sub *Mnio*). *G. Mnemosyne*, Ehrh. l. c.; C. Muell. Synops. Musc. p. 182. *Tetraphis pellucida*, Hedw.; Br. Europ. *Tetraphis* (cum ic.); M. P. 319.

Hab. Z₀₋₂ ad ligna putrida.

127. *G. Browniana*, Dicks. Crypt. Fasc. 4. p. 7. t. 10. f. 6 (sub *Bryo*); C. Muell. Synops. Musc. p. 181. *Tetrodontium Brownianum*, Schwgr. Suppl. t. 128.

Hab. Z₂ P. c. locis occultis ad rupes arenaceas, &c. præprimis ferro oxydatas: rara et semper *Campylostelium saxicola* consociata. *Labassère. V. de Castelloubon.*

Tribus 12. BRYACEÆ.

(*Bryaceæ* et *Mielichhoferiæ*, Br. Europ.)

19. *Mielichoferia*, Hornsch. et Nees.

128. *M. nitida*, H. et N. Br. Germ. P. 2. § 2. p. 183. t. 41; Br. Europ. ! *Mielichof.* (cum ic.); M. P. 98.

Hab. Z₁₋₄ P. occ. et c. in rupibus argillaceo-schistosis, locis *Gorge de Cautelets* et *Port de Bénasque*. P. or. *Crabère* (Arnott!); in convalle *Eynes* (Montagne, l. c.); in valle de *Lio* (Thomas in Br. Europ.).

20. *Bryum*, Dillenius.

§ 1. (= *STENOBRYUM*, Wils. in litt.)

129. *B. pyriforme*, L. fil. (sub *Mnio*); Br. Europ. *Bryum*, t. 18.

Hab. Z_{1 sup.} P. c. locis *route de Bagnères à Gazos* et *bords de la route de Toulouse*, ubi invenit am. Philippe !

§ 2. *ELONGATA*.

130. *B. acuminatum*, Hoppe et Hsch. Bot. Zeit. 1819, p. 94 (sub *Pohlia*); Br. Europ. ! l. c. p. 21. t. 6; M. P. 107.

Hab. Z₂₋₄ in rupibus terra obtectis Pyr. centralium. *Esquierry. Lac d'Espingo. En montant au Lac Lehou* (Philippe!).

Var. *β. minus*, Br. Europ. l. c.; M. P. 108. *Pohlia minor*, Schleich.; Schwgr. Suppl. t. 64.—*Hab.* ad viarum cavarum la-

tera in regione sylvatica. P. occ. *Gorge de Caunterets*; *Pont d'Espagne*. P. c. *Chaos de Gavarnie*.

Florescentia haud semper *monoica*; nonnunquam *hermaphrodita* est, et in tali re *sterilis*; quandocunque autem *dioica* invenitur tunc plerumque *fertilis*!

131. *B. polymorphum*, H. et H. Bot. Zeit. 1819, p. 95 (sub *Pohlia*); Br. Europ. ! l. c. p. 25. t. 8; M. P. 109.

Hab. Z_2 terrestre in abiegnis juxta pontem dict. *d'Espagne*.

Var. *curvisetum*, Br. Europ. l. c. *Pohlia curviseta*, H. et H. l. c. p. 98.—*Hab.* Z_{3-4} *V. de Combascou. Esquierry. Port de Bénasque*. In P. or. locis *Mt. Canigou* et *Vallée d'Eynes* detexit cl. Arnott!

132. *B. elongatum*, Dicks. Crypt. Fasc. 2. p. 8; Br. Europ. ! l. c. p. 32. t. 10.—Var. 1, M. P. 110.

Hab. Z_{1-3} ad vias cavas, in rupibus terra obtectis, &c., per totos *Pyrenæos* sylvaticos.

“Var. 2. foliis angustissimis, *peristomio interno perfecto*. Ad *Br. elongatum* γ . *macrocarpum*, Br. Europ. accedit.” M. P. 111.—*Hab.* ad pinorum truncos cariosos in monte *Crabioules*.

“Var. 3. foliis brevioribus, capsulis longioribus, *peristomii interni ciliis subnullis*.” M. P. 112.—*Hab.* circa *B.-de-Luchon* in sylvaticis editioribus, terrestre, locis *Bois de Sajust, Lac de Séculéjo*, &c.

133. *B. longicollum*, Sw. Musc. Suec. pp. 49, 99. t. 6; M. P. 133.

Hab. Z_2 P. c. in rupium fissuris juxta lacum *Séculéjo*.

134. *B. crudum*, Schreb. Fl. Lips. p. 83; Br. Europ. l. c. p. 37. t. 13; M. P. 114.

Hab. $Z_{1\text{ sup.}-4}$ in rupibus montium humiliorum, frequens: rarius in alpes ascendens (*Port de Bénasque*).

§ 3. NUTANTIA.

135. *B. nutans*, Schreb. Fl. Lips. p. 81; Br. Europ. l. c. p. 34. t. 12; M. P. 115.

Hab. Z_{0-4} ad terram in sylvis, nec non in alpinis.

136. *B. Ludwigii*, Spreng. var. β . *gracile*, Bryol. Europ. l. c. p. 39. t. 14; M. P. 119.

Hab. Z_4 P. c. in vicinia molium glacialium montis *Crabioules*; secus ripas lacus *Lehou* (Philippe!).

137. *B. albicans*, Wahl. in Web. et Mohr Ind. Musæi. *B. Wahlenbergii*, Schwgr.; Br. Europ. l. c. p. 44. t. 17; M. P. 118.

Hab. (*forma typica*) Z_1 ad rivulorum ripas circa *Gélos*, P. occ.: rarius.

Var. *glaciale*, Br. Europ. l. c. *Bryum glaciale*, Schleich. in Brid. Br. Univ. 1. p. 852.

Hab. Z₄ P. c. in eodem loco ac *B. Ludwigii* β. P. or. V. d' Eynes (Arnott!).

138. *B. carneum*, L. Sp. Pl. p. 1587; Br. Europ. l. c. p. 43. t. 16; M. P. 116.

Hab. Z₁ P. c. in rivulorum glareosis circa *B.-de-Bigorre*: rarius.

139. *B. Tozeri*, Grev. Scot. Crypt. Fl. t. 285; M. P. 117.

Hab. Z₀₋₁ inf. P. occ. in argillaceo-arenosis circa *Pau* et *St. Sever*; in rupibus ophiticis *Sti. Pandelon* prope Aq. Tarbellicas. Autumno et vere fructificat.

§ 4. JULACEA.

140. *B. julaceum*, Smith, Fl. Brit. p. 1357; H. et T. ! Musc. Brit. p. 197. t. 28; Schwgr. Suppl. t. 195; M. P. 120.

Hab. Z₂ P. c. ad rupes humectas juxta cataractam dict. *la Cascade du Cœur*: nusquam alias visum.

141. *B. concinnum*, Spruce in Musc. Pyr. n. 121: dioicum, *gracilescens*, parce ramosum; *caule ramisque tereti-julaceis*; foliis nitidis, erectis, imbricatis, ovatis et ovali-lanceolatis, *breviter apiculatis*, concavis, integerrimis vel sub apice obsolete denticulatis, anguste areolatis, *marginibus planis, nervo cum apice evanido*.

Hab. Z₁ P. occ. in rupibus humidiusculis ad viam quæ ducit a pago *Pierrefitte* ad opp. *Cauterets*; P. c. in via cava ad pedem montis *Superbagnères* prope *B.-de-Luchon*.—In Anglia ad cataractam *Caldron Snout* dictam fl. *Tees*, mense Julio, 1843, detexi.—Planta ♀ sola, sterilis, hucusque observata.

Pusillum, cæspitosum; cæspites in parte inferiori tomento radiculoso cohærentes. *Caulis* $\frac{1}{2}$ –1 unc. erectus vel ascendens, julaceus, e basi ipsa uno eodemque modo foliosus, ramos nonnullos teretes plerumque simplices, inferiores sæpius fastigiatos proferens, inferne rubellus, superne viridis. *Folia* erecta, imbricata, ovata v. ovali-lanceolata, apiculo brevi subreflexo, concava, alis basilaribus inflexis, margine ipsa plana, integerrima, rarius ad apicem versus obsolete denticulata, nervo percurrente instructa, e cellulis elongato-rhomboides-hexagonisve minoribus curvulis, superne arctius, basi cellulis latioribus laxius, areolata, inferiora paulo longiora fuscescentia, superiora pallide viridia nitida. *Flores* *feminei* terminales seu pseudolalares; *folia* erecta, elongato-lanceolata, subplana, interiora minora; *archegonia* et *paraphyses* numerosi, pari longitudine.

Differt *B. julaceum*, Smith, statura majori, *foliorum apice obtusiori subinflexo, nervo ante apicem evanido*, areolisque angustioribus; *B. atropurpureum* gemmiparum (= *B. gracilentum* Tayl. olim) *foliis erecto-patulis, brevioribus, apiculo obtuso* quasi truncato terminatis, e cellulis minus elongatis conflatis; *B. Funkii*, Schwgr., *foliis nervo validiori excurrente instructis, areolisque multo majoribus*; *B. Blindii*,

Schimp., *foliis evanidinerviis*; *B. semiovatum*, Brid., *foliis nervo crasso apicem excedente*.

Obs. In foliorum superiorum axillis nonnunquam adsunt gemmæ fasciculatæ (2-9-natæ) saturate purpurascentes, folia minuta arcte imbricata sistentes, iis *B. julacei* haud absimiles.

§ 5. ARGENTEA.

142. *B. argenteum*, L. Sp. Pl. p. 1586; Br. Europ. *l. c.* p. 78. t. 41.

Hab. Z_0^{-1} in ruderatis, muris, &c.

143. *B. Zierii*, Dicks. Crypt. Fasc. 1. t. 4. f. 10; Br. Europ. *l. c.* p. 29. f. 9; M. P. 122.

Hab. Z_{2-3} in rupibus humidiusculis. P. c. *Lac de Séculéjo*; *Labassère*, &c. P. or. *Mont Louis* (Arnott!).

§ 6. CÆSPITICIA.

144. *B. pallens*, Sw. Musc. Suec. p. 47. t. 4; Br. Europ. ! *l. c.* p. 68. t. 33; M. P. 123. *B. turbinatum*, H. et T. ! Musc. Brit. p. 202. t. 29.

Hab. Z_{1-3} in humidis præcipue secus rivulos, frequens.

145. *B. pallescens*, Schwgr. Suppl. t. 75; Br. Europ. ! *l. c.* p. 51. t. 22; M. P. 124.

Hab. Z_{2-3} plerumque secus rivulos, haud rarum. *Les Eaux Chaudes*; *Chaos de Gavarnie*; *Lac Lehou* et *Pic du Midi* (Philippe!), &c. In tugurii pastoricii tecto ad latus orientale montis *Tourmalet*.

146. *B. bimum*, Schreb. Fl. Lips. p. 83; Br. Europ. *l. c.* p. 50. t. 21.

Hab. Z_2 P. or. *Vallée d'Eynes* (Arnott!).

147. *B. cirrhatum*, H. et H. Bot. Zeit. 1819, p. 70; Br. Europ. fasc. 32. p. 8. t. 11.

Hab. Z_{3-4} in humidis graminosis P. c., locis *Esquierry* et *Port de Bénasque*.

148. *B. inclinatum*, Sw. Musc. Suec. p. 45 et 96 (sub *Pohlia*); Br. Europ. ! *Bryum*, p. 17. t. 3; M. P. 125.

Hab. Z_{1-2} ad terram saxaque, sed rarius. P. occ. circa *Cauterets*. P. c. *V. de Lesponne*. P. or. *Cambrédazes* (Arnott!).

149. *B. cernuum*, Hedw. Sp. Musc. p. 58. t. 9 (sub *Cynodontio*); Br. Europ. *l. c.* p. 14. t. 1.

Hab. Z_{1-4} ad saxa, rarius. P. occ. *Oloron*. P. c. prope pagum *Luz*; *Pic du Midi* à 1300 toises (Philippe!).

150. *B. cæspiticium*, L. Sp. Pl. p. 1586; Br. Europ. *l. c.* t. 34.

Hab. Z_1 P. occ. prope *Oloron*, ubi *cæspitem unicum* inveni!!

? Var. γ . *imbricatum*, Br. Europ. *l. c.* p. 70. t. 35; M. P. 126. —*Hab.* ad muros in valle *Campan* juxta *Ste. Marie*, sterile.

151. *B. erythrocarpon*, Schwgr. Suppl. t. 70.

Hab. Z₁ P. occ. supra pagum *Jurançon*, in solo arenoso juxta rivulum.

152. *B. atropurpureum*, W. et M. Ind. Mus. ; Br. Europ. l. c. p. 73. t. 37 ; M. P. 127.

Hab. Z₀₋₁ in muris, ad terram, &c., vulgatum.

153. *B. alpinum*, L. Mant. 2. p. 309 ; Br. Europ. l. c. p. 76. t. 39 ; M. P. 128.

Hab. Z_{1 sup.-3} in saxis secus rivulos : fructiferum juxta thermas supra pagum *Penticosa* Aragoniæ, etiam in faucibus dict. *Gorge de Luz* et *Gorge de Labassère*.

154. *B. pseudotriquetrum*, Hedw. Musc. Frond. 3. t. 7 (sub *Mnio*) ; Br. Europ. l. c. p. 54. t. 24 ; M. P. 129. *B. ventricosum*, Dicks. ; H. et T. ! Musc. Brit. p. 205. t. 30.

Hab. Z_{1 sup.-3} in rupibus humidis, frequens.

155. *B. turbinatum*, Hedw. var. *γ. latifolium*, Br. Europ. ! l. c. p. 65. t. 32 ; M. P. 130. *B. Schleicheri*, Schwgr. Suppl. t. 73.

Hab. Z₃₋₅ ad fontes in alpinis. *Penticosa* ; *Lac de Séculéjo* ; *Mt. Maladetta*, &c. *Vallon d'Arise* (Philippe !).

§ 7. CAPILLARIA.

156. *B. obconicum*, Hornsch. ; Bryol. Europ. ! l. c. p. 59. t. 27 ; M. P. 131.

Hab. Z₁ P. occ. et c. ad muros, haud infrequens. *Jurançon* ; *Bagès* ; *Arreau*, &c. *Bagnères* (Philippe !).

157. *B. platyloma*, Schwgr. Suppl. 1. P. 2. p. 116. t. 76 (non Br. et Sch.) ; M. P. 132.

Hab. Z₁ P. c. in rupibus humidiusculis prope pagum *Pierrefitte*.

This plant agrees closely with Schwaegrichen's figure and description above-cited, with the sole exception that the stems are rather more elongated. Through the favour of Mr. Wilson I have examined specimens gathered in the Canary Islands by Mr. Webb, and named "*Br. platyloma*, Schwgr." by Dr. Montagne : these agree in all characters of importance with the Pierrefitte plant. The latter differs essentially from the *B. platyloma* of B. and S. (*B. Donnianum*, Grev.) in the leaves having a broad margin of 4-6 rows of cellules ("in sex circiter series digestæ," Schwgr. l. c.), but composed of only a single layer ; while those of *B. Donnianum* have a margin only 2 or 3 cellules in width, but decidedly thickened ("margine e strato duplici cellularum . . . circumducta," Br. Europ.), in other words they are *pachylomatous* but not *platylomatous*. The leaves of the true *B. platyloma* differ further in being far smaller, rigid, nearly erect, by no means "in comam patulam congesta" (as represented in 'Bryol. Europæa,' but not in Schwaegrichen), the strong nerve running out into a point

which equals $\frac{1}{3}$ or $\frac{1}{4}$ of the rest of the leaf, while those of the 'Bryol. Europæa' plant "n'offrent ordinairement qu'une pointe courte, formée par le rapprochement des bords de la feuille." In habit the two plants differ very considerably.

There is still one doubt remaining, namely whether *B. platyloma*, Schwgr., and *B. obconicum*, Hornsch., be merely forms of one and the same species. There is some difference in external aspect, and the latter has the leaves *scarcely marginated*, paler and less rigid, with a longer-necked, *perfectly symmetrical* and usually more pendulous capsule.

158. *B. torquescens*, B. et S. Br. Europ. l. c. p. 49. t. 20; M. P. 133.

Hab. Z₀₋₁ P. occ. ad terram prope Jurançon et Cauterets.—Circa Montpellier (Arnott!).

"Var. *florescentia monoica*;" M. P. 134. *B. fuscescens*, nob. in hb.—*Hab.* Z₀₋₁ P. occ. prope St. Sever in Agro Syrtico, loco Landes de Mugriet, in terra arenosa; etiam in muro prope Oloron.

(*Descr. varietatis.*) *Plantæ* gregariæ. *Folia* fuscescentia, *subpattula*, siccando appressa *parum tortilia*, elongato-obovata, apiculata, nervo tenui excurrente cuspidata, concava, *haud carinata*, 2-3 cellularum angustiorum seriebus marginata, apice denticulata. *Flores* *feminei constricti*, 6-8 folii. *Flores masculi gemmiformes ad feminei basin nati*, sessiles vel in innovationibus terminales (rarius in planta propria); *folia perigonialia* sub-6, conniventia, exteriora ovato-acuminata, interiora minora, late-ovata, apiculata, antheridia numerosa paraphysibus numerosis sublongioribus stipata, complectentia. *Capsula* in pedunculo basin versus geniculato arcuatove subpendula, elongato-pyriformis, fere clavata, e fusco purpurascens. *Operculum* convexum, apiculatum, aurantiacum, nitens. *Peristomium*: externi dentes pallidi; *internum* membrana in processus carina valde pertusos *apice attenuatos*, ciliis 2-3-nis appendiculatis interjectis, fere ad medium fissa. *Annulus* latus, compositus. *Sporæ* olivaceæ.

The *monoicous inflorescence* is so constant a character in all the individuals from the two localities above-cited, that I am led to suppose this will prove a distinct species. In the typical form of *B. torquescens*, from Jurançon and Cauterets, the fertile flowers are all *hermaphrodite*, and quite *turgid* from the *numerous antheridia* they enclose along with the archegonia. Yet a minute comparison of all the other parts does not reveal any marked difference in the two plants, and I prefer waiting for further evidence before I undertake to decide on their being distinct or otherwise.

159. *B. capillare*, Hedw. Sp. Musc. p. 182; Br. Europ. l. c. p. 60. t. 28.

Hab. Z₀₋₄ "Var. 1." M. P. 135 (= *B. capillare* a. Br. Europ.): in planitie et montibus humilioribus, fere ubique ad saxa, &c.

"Var. 2. foliis longioribus, obovato-lanceolatis, siccitate patulis vix tortilibus (minime *spiraliter* tortis), capsulis elongatis

pallidis;" M. P. 136.—*Hab.* Z_{2-3} ad truncos putrescentes locis *Pont d'Espagne, Hourquette d'Aspin, Lac de Séculéjo, &c.*

"Var. 3." M. P. 137 (= *B. capillare* β . *cochlearifolium*, Brid. Br. Univ. 1. p. 666 = *B. capillare* η , Br. Europ.).—*Hab.* Z_{3-4} in alpinis, saxatile et terrestre, rarissime fertile. P. occ. *V. de Combascou.* P. c. *Lac Lehou; Esquierry.* P. or. in monte *Canigou* (Arnott!).

160. *B. Donnianum*, Grev. ! in Linn. Soc. Trans. 15. p. 345. t. 3. f. 6. *B. platyloma*, Br. Europ. l. c. p. 58. t. 26 (non Schwgr.). *B. Muelleri*, M. P. 138.

Hab. Z_0 in terra arenosa Agri Syrtici prope *St. Sever*, sterile.

I published this in 'Musci Pyrenaici' as *B. Muelleri* mst., feeling convinced that it was perfectly distinct from the *B. platyloma* of Schwgr. (See above, under No. 157, for an exposition of the differences of the two species.) I owe to Mr. Mitten the suggestion that it is in reality the *B. Donnianum* of Greville, which we have since confirmed by an examination of the author's original specimens. The fertile plant has been found in Sussex by Messrs. Mitten and Jenner.

161. *B. roseum*, Schreb. Fl. Lips. p. 84; Br. Europ. l. c. t. 25; M. P. 139.

Hab. Z_1 in sylvis, plerumque sterile. Fertile in sylva *Bois de Gerde dicta* (Philippe!).

21. *Mnium*, Dillenius, Linnæus.

162. *M. spinosum*, Voit in Sturm. Flor. Germ. Crypt. 11. t. 16 (sub *Bryo*); Br. Europ. fasc. 5, *Mnium*, p. 26. t. 6; M. P. 140.

Hab. Z_2 P. c. sub abietum umbra juxta pontem *Pont d'Espagne dictum.*

163. *M. spinulosum*, B. et S. ! Br. Europ. fasc. 31. p. 4. t. 4.

Hab. Z_2 P. c. cum priore; etiam in trunco carioso *V. du Lys.*

164. *M. hornum*, L. Sp. Pl. p. 1576; Br. Europ. fasc. 5. p. 22. t. 4.

Hab. Z_{0-2} in sylvis, haud vulgatum.

165. *M. serratum*, Schrad. Spic. Fl. Germ. p. 71 (sub *Bryo*); Br. Europ. l. c. p. 24. t. 5.

Hab. Z_{1-2} in umbrosis præcipue secus rivulos. *Les Eaux Bonnes, &c. En montant au Lac Lehou* (Philippe!). *V. d'Eynes* (Arnott!).

166. *M. lycopodioides*, Br. Europ. fasc. 31. t. 2. (An *Bryum lycopodioides*, Hook. in litt. ad Schwgr.?)

Hab. Z_2 P. c. *Vallon de Courbettes* (Philippe!).

167. *M. orthorhynchum*, Br. Europ. fasc. 5. p. 25. t. 5 (non Bridel).

Hab. Z_{1-2} P. occ. et c. : socio *M. serrato*. *Les Eaux Bonnes. Col de Louvie. Vallon de Courbettes*, etiam en montant au Lac Lehou (Philippe!).

168. *M. undulatum*, Hedw. Sp. Musc. p. 195; Br. Europ. *l. c.* p. 20. t. 3.

Hab. Z_{0-1} in umbrosis : fertile circa *Dax* (Grateloup!), *Pau* (Southby!) et *B.-de-Bigorre* (Philippe!).

169. *M. affine*, Bland. Musc. Exs. fasc. 3. n. 153; Br. Europ. *l. c.* p. 30. t. 9.

Hab. Z_1 locis umbrosis humidiusculis : fertile prope *B.-de-Bigorre* (Philippe!).

170. *M. medium*, B. et S. ! Br. Europ. *l. c.* p. 32. t. 12; M. P. 142 (*forma major*).

Hab. Z_2 P. c. in saxosis umbrosis secus rivulos sylvæ *Bois de Gouerdère* dictæ prope *B.-de-Luchon*.

171. *M. rostratum*, Schrad. Spicil. p. 72 (sub *Bryo*); Br. Europ. *l. c.* p. 27. t. 7; M. P. 143.

Hab. Z_1 ad latera viarum cavarum.

172. *M. cuspidatum*, Hedw. Sp. Musc. p. 192. t. 45; Br. Europ. *l. c.* p. 29. t. 8.

Hab. Z_1 in sylvaticis humidis, rarius. *Jurançon. V. du Lys.*

173. *M. punctatum*, Schreb. Fl. Lips. p. 85 (sub *Bryo*); Br. Europ. *l. c.* p. 19. t. 2; M. P. 144.

Hab. Z_{1-2} in scaturiginosis.

174. *M. stellare*, Hedw. Sp. Musc. t. 40; Br. Europ. ! *l. c.* p. 33. t. 13; M. P. 145.

Hab. Z_{1-2} P. occ. et c. supra ligna putrida inque saxosis umbrosis montis *Goursi* prope *les Eaux Bonnes*; nec non in valle du *Lys* et circa *B.-de-Bigorre* : rarissime fructiferum.

† “*M. latifolium*, foliis ovato-subrotundis solidinervibus marginatis subdenticulatis concavis, caule longo subsimplici.

“Lectum est a Schleichero in Helvetia, missum e Pyrenæis; sine flore.

“Foliorum forma *punctato* aliquo modo simile, si madet; sed habitu et foliis erecto-incumbentibus, siccitate parum plicatis, distinctum. Locum hic habet propter foliorum texturam, *Mnio* similem.” Schwgr. Suppl. 1. P. 2. p. 138.

Very probably this is nothing more than a sterile form of *B. punctatum*, such as I have myself gathered in the Vallée de Lutour, remarkable for its elongated stems and appressed leaves when dry : hence resembling externally *M. cinclidioides*, Blytt.

22. *Aulacomnion*, Schwgr.

175. *A. androgynum*, L. Sp. Pl. p. 1574 (sub *Bryo*); Br. Europ. *Aulacomnion*, p. 11. t. 4; M. P. 146.

Hab. Z_1 in rupibus umbrosis, rarum. P. occ. *Gave de Gabas*. P. c. *Forêt de Transoubât* (Philippe!).

176. *A. palustre*, L. Sp. Pl. p. 1574 (sub *Bryo*); Br. Europ. l. c. p. 9. t. 3.

Hab. Z_1 in paludosis. P. c. prope *Bagnères* (Philippe!). P. or. *Mt. Canigou* (Arnott!).—Plantam per Europam septentrionalem *vulgatissimam* nusquam in Pyrenæis loco natali conspici mihi contigit!

23. *Timmia*, Hedwig.

177. *T. Megapolitana*, Hedw. Musc. Frond. l. p. 83. t. 31; Br. Europ. *Timmia*, t. 1.

Hab. Z_3 P. c. *Pic du Midi de Bigorre* (Philippe!). P. or. *Mt. Canigou*, *Mt. Cady* et *Cambrédazes* (Arnott!).

178. *T. austriaca*, Hedw. Sp. Musc. p. 176. t. 42; Br. Europ. l. c. t. 2.

Hab. "in Pyrenæis" (Bryol. Europ.).—Planta mihi haud obvia.

Tribus 13. POLYTRICHACEÆ, Bryol. Europ.

24. *Polytrichum*, Dillenius.

§ 1. (= CATHARINEA, Ehrh. = ATRICHUM, P. Beauv.)

179. *P. undulatum*, L. Sp. Pl. p. 1530 (sub *Bryo*); M. P. 300; Br. Europ. *Atrichum*, p. 8. t. 1, 2.

Hab. Z_{0-3} in umbrosis humidiusculis.

180. *P. angustatum*, Hook. Musci Exot. t. 50; M. P. 301; Br. Europ. *Atrichum*, p. 9. t. 3. *Catharinea a.*, Brid.; Sulliv. ! Musci Allegh. n. 118.

Hab. Z_{0-1} P. c. in collibus siccis dumetosis sylvæ *Bois de La-gaillaste* dictæ prope *B.-de-Bigorre*. P. occ. locis similibus *Sti. Pandelon* prope *Dax*.

§ 2. (= OLIGOTRICHUM, DeCandolle.)

181. *P. hercynicum*, Hedw. Musc. Frond. l. t. 13; M. P. 302; Br. Europ. *Oligotrichum*, t. 5.

Hab. Z_{3-4} P. c. in regione inferalpina montis *Crabioules*, terrestre; in alpinis juxta lacum *Lehou* et supra pagum *Gazos* (Philippe!).—? "*Dax*, dans les endroits tourbeux." (Thore in Fl. Franç.)

§ 3. (= POGONATUM, Pal. Beauv.)

182. *P. nanum*, Hedw. Musc. Frond. l. t. 13; M. P. 303; Br. Europ. *Pogonatum*, p. 5. t. 7.

Hab. Z_{0-1} ad aggeres arenosas subhumidas.

The obscurely toothed (not sharply serrate) leaves and their wavy lamellæ afford good characters for distinguishing this species from *P. aloides*. I gathered near Pau, by the Bordeaux road, an ano-

malous *Polytrichum*, which may possibly be a starved form of *P. nanum*. It has the capsule subcernuous, nearly spherical; the *columella* 4-sulcate, or rudimentarily alate (not *terete* as in typical *P. nanum*); and the *calyptra* sheathing the whole of the capsule.

183. *P. aloides*, Hedw. Musc. Frond. 1. t. 14; M. P. 304; Br. Europ. *Pogonatum*, p. 6. t. 8.

Hab. Z_{0-3} in humidiusculis, præsertim in arena rivulorum, altius versus alpes ascendens quam *P. nanum*.

184. *P. urnigerum*, L. Sp. Pl. p. 1573; M. P. 305; Br. Europ. *Pogonatum*, p. 7. t. 9.

Hab. Z_{0-2} in arenosis humidiusculis.

185. *P. alpinum*, L. Sp. Pl. p. 1573; Br. Europ. *Pogonatum*, p. 9. t. 10.

Hab. Z_{2-4} P. c. in monte *Crabioules*.

Var. caule valde elongato, subsimplici; M. P. 306.—*Hab.* in saxosis umbrosis vallis *Lutour* prope *Cauterets*.

The curious way in which the *epiphragm* (the *tympaniform* dilatation of the summit of the *columella*) is attached to the peristome in this and other *Polytricha* does not seem to have been anywhere described. In *P. alpinum* it is originally placed at the base of the teeth, to which it is attached by means of processes equaling them in number and exactly covering their internal face. After the fall of the lid, these processes are gradually detached and the *epiphragm* rises, probably from the pressure of the full-grown spores beneath it, so as to allow the latter to escape through the interstices of the peristome. When the *epiphragm* is quite liberated, either naturally or by art, the processes curve inwards upon its upper surface (see Pl. I. fig. 1) so as to be with difficulty seen, unless the light be properly regulated or the *epiphragm* be set up on its edge. The processes are composed of only a single layer of cellules, which are so disposed that their interstices form vertical lines corresponding to those on the teeth.

The adhesion of the *epiphragm* to the teeth is so great as to resist the action of the *columella* to draw it down into the capsule, and often ultimately to cause the rupture of the *columella*. The ragged portion at the underside of the section (fig. 2) is where the rupture takes place between the *columella* and the *epiphragm*.

In *P. urnigerum*, *aloides* and *nanum* the *epiphragm* is attached to the teeth in the same manner, but the processes are very thin and tender, and when the *epiphragm* is detached by force they often remain adhering to the teeth. In *P. angustatum* (as also probably in *P. undulatum*) the processes are united to each other by an intervening membrane, which is *granulated* on the surface, while the processes themselves are *smooth* and marked by lines similar to those on the teeth: in other words, the *epiphragm* is bordered by an inflexed *continuous* membrane, by means of which it adheres to the peristome. The figure of *P. angustatum* in 'Bryol. Europæa' represents this pretty well, but no mention is made of it in the text.

§ 4. (= POLYTRICHUM, Brid. et Bryol. Europ.)

186. *P. sexangulare*, Hoppe, Bot. Taschb. p. 150; Br. Europ. *Polytrichum*, p. 7. t. 11.

Hab. Z₃₋₄ P. c. locis *Esquierry* et *Port de Paillère* (Arnott!).

187. *P. formosum*, Hedw. Sp. Musc. t. 9; Br. Europ. *Polytrichum*, p. 9. t. 12; M. P. 307.

Hab. Z₀₋₂ ad terram in sylvis, haud infrequens.

188. *P. commune*, L. Sp. Pl. p. 1573; Br. Europ. *Polytr.*, p. 13. t. 17; M. P. 308.

Hab. Z₀₋₂ in Agri Syrtici ericetis; in Pyrenæorum rupestribus humidis.

189. *P. juniperinum*, Hedw. Sp. Musc. t. 13; Br. Europ. *Polytr.*, p. 12. t. 15; M. P. 309.

Hab. Z₁₋₅ in rupibus terra obtectis, e montibus humilioribus usque in summos alpes ascendens.

190. *P. piliferum*, Schreb. Fl. Lips. p. 74; Br. Europ. *Polytr.*, p. 11. t. 14; M. P. 310.

Hab. Z₁₋₄ locis sterilibus ventosis: haud vulgare.

Tribus 14. BUXBAUMIACEÆ, Bryol. Europ.

25. *Buxbaumia*, Haller.

191. *B. aphylla*, Hall. Stirp. Helv. 2. p. 83; Br. Europ. fasc. 1 (cum icone).

Hab. Z₀ P. occ. in vicinia *St. Sever*, ubi in declivibus arenosis umbrosis secus fl. *Adour* ripas invenit cel. Dufour!

192. *B. indusiata*, Brid. 1. p. 331. t. Suppl. 2; Br. Europ. fasc. 1. p. 6. t. 2.

Hab. Z₁₋₂ in truncis putridis, rarissime. P. occ. in regione media montis *Pic de Ger*; nec non in valle *Jéret*. P. c. *Vallée de Campan* in sylva *Forêt de Paiollet* dicta (Philippe!).

26. *Diphyscium*, Web. et Mohr.

193. *D. foliosum*, L. Syst. Veg. ed. 14. p. 925 (sub *Buxbaumia*); Br. Europ. fasc. 1. p. 3. t. 2; M. P. 320.

Hab. Z₀₋₁ ad terram in sylvis, vulgatum.

Tribus 15. MEESIACEÆ, Bryol. Europ. (ex parte).

27. *Meesia*, Hedwig.

194. *M. trichodes*, L. Succ. n. 1006 (sub *Bryo*); M. P. 147. *Meesia uliginosa*, Hedw.; B. et S. ! Br. Europ. fasc. 10. p. 5. t. 1.

Hab. Z₂₋₄ P. occ. in spongiosis montis *Lizé*. P. c. secus ripas lacus *Lehou*; *Vallon du Houre* (Philippe!); *Esquierry* (Arnott!). P. or. *V. d'Eynes* (Arnott!).

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Tribus 16. FUNARIACEÆ, Bryol. Europ. (ex parte).

28. *Amblyodon*, Pal. Beauv.

195. *A. dealbatus*, Dicks. Crypt. fasc. 2. p. 8. t. 5. f. 3 (sub *Bryo*); Br. Europ. *Amblyodon* (cum ic.).

Hab. Z_2 in spongiosis. P. occ. in monte *Lizé*, socio *Meesia trichode*. P. or. *Port Nègre* (Arnott!).

29. *Funaria*, Schreber.

196. *F. hygrometrica*, L. Sp. Pl. p. 1575 (sub *Mnio*); Br. Europ. *Funaria*, t. 3; M. P. 148.

Hab. Z_0-3 locis exustis, ruderalis et calcareis.

197. *F. convexa*, Spruce in *Musci Pyr.* 149. *F. serrata*, B. et S. Br. Europ. *Funaria*, p. 8. t. 2 (non Brid. Br. Univ. 2. p. 57).

Hab. Z_0 P. occ. *St. Sever*, in aggeribus arenosis, socio *F. Muehlenbergii*, a quo *operculo convexo* nequitquam convexo-conico primo visu dignoscenda.

I had come to the conclusion that this moss must be distinct from the *F. serrata* of Bridel (whose specimens were Pennsylvanian ones communicated by Palisot-de-Beauvois) before I had the opportunity of examining the specimens so named by Hooker and Wilson in Drummond's 'Mosses of the Southern States,' &c., No. 76, and those of Sullivant in his beautiful 'Musci Alleghanyenses,' No. 126; and it is satisfactory to find my opinion supported by the decisions of these eminent botanists. The American specimens agree much better with Bridel's description in the form of the leaves, &c. than do those of Bruch and Schimper. I find the perichætal leaves of the former to be *oblong-lanceolate*, acute or subapiculate (*never acuminate*), plane, *serrated almost to the very base*, the rather strong nerve reaching *nearly to the point*, and it is sometimes only with a tolerably high power that it can be ascertained to fail one or two cellules below it. Bridel calls the leaves "*acuminata*" in his spec. char., but in his description he uses the more applicable term "*acutiuscula*." Of the nerve he says "*proxime sub apicem abrupto nunc paulum excurrente*:" I have never seen it excurrent, but it may well have appeared so in some cases with the inferior instruments which Bridel seems to have used.

F. convexa has the leaves larger, proportionally *much wider*, *spathulato-acuminate* ("*forma peculiari, subspathulata*," Br. Europ.), concave, the marginal serratures rarely descending below the middle, *the feeble nerve only $\frac{3}{4}$ the length of the leaf*, and the areolation wider; the pedicel shorter, when dry *twisted to the right*; the mouth of the capsule more oblique and the teeth of the peristome with fewer articulations.

F. convexa is distinguished from *F. Muehlenbergii* by another obvious character, besides the one above-mentioned, namely by the calyptra being *persistent* on full-grown dried capsules, its beak *pointing downwards* and usually parallel to the pedicel; whereas in the

latter, the calyptra is *rarely persistent* on nearly mature capsules, in the dried state, and in these rare cases it is nearly *erect*. See also Bryol. Europæa, *loc. cit.*

198. *F. Muehlenbergii*, Turn. in Ann. of Bot. 2. p. 198; Schwgr. Suppl. t. 66; Bryol. Europ. *l. c.* t. 1; M. P. 150.

Hab. Z_{0-1} P. occ. in solo arenoso circa *St. Sever*. P. c. in rupibus calcareis terra obtectis juxta thermas dict. *de Salut, B.-de-Bigorre*.

I gathered very sparingly on mortar in a wall near Oloron, a *Funnaria* almost intermediate between this species and *F. hibernica*. The leaves are rarely obovate, usually ovate, acute or subapiculate; the nerve stronger than in *F. Muehlenbergii*, and failing very little below the apex; the margins almost quite entire. Pedicel when dry *twisted to the left*, except just beneath the capsule, where there is usually one turn to the right.

30. *Entosthodon*, Schwgr.

199. *E. Templetoni*, Hook. in Fl. Lond. ed. 2 (sub *Weisia*); H. et T. ! Musc. Brit. p. 77. t. 14; Br. Europ. *Entosthodon* (cum ic.); M. P. 151.

Hab. Z_0 P. occ. in Agro Syrtico circa *St. Sever* et *St. Pandelon*, ubi ad terram arenosam socio *Physcomitrio fasciculari* viget.

31. *Physcomitrium*, Brid.

200. *Ph. ericetorum*, De Not. Syllab. p. 283; Bryol. Europ. *Physcomitrium*, p. 13. t. 3; M. P. 152. *Gymnostomum fasciculare*, H. et T. ! Musc. Brit. p. 23. t. 7.

Hab. Z_{0-1} P. occ. ad fossarum margines circa *Pau* et *St. Sever*.

201. *Ph. fasciculare*, Hedw. Sp. Musc. t. 4 (sub *Gymnostomo*); Br. Europ. ! *l. c.* p. 13. t. 4; M. P. 153.

Hab. Z_{0-1} cum præcedente; etiam P. c. circa *B.-de-Bigorre*.

202. *Ph. pyriforme*, Hedw. Sp. Musc. p. 38 (sub *Gymnost.*); Br. Europ. *l. c.* p. 11. t. 2; M. P. 154.

Hab. Z_{0-1} in iisdem locis ac n. 201.

203. *Ph. acuminatum*, Schleich. Cat. Plant. Helvet. p. 40 (sub *Gymnost.*); Br. Europ. *l. c.* p. 11. t. 3.

Hab. Z_1 sup. in muro e limo constructo supra viculum *Bagès* vallis d' *Ossau*: rarissime.

32. *Ephemerum*, Hampe in Linnæa, 1832.

204. *E. serratum*, Schreb. de Phasco, p. 9. t. 2 (sub *Phasco*). *Phasum serratum*, Br. Europ. fasc. 1. p. 6. t. 1.

Hab. Z_1 in agris cultis prope *B.-de-Bigorre*, rarissime.

In the 'Synopsis Muscorum' of C. Mueller (Berolini, 1848), where the classification of the genera displays much originality and acuteness of observation, the *Ephemera*, along with *Ephemerella*,

C. M., and *Voitia*, Hornsch., form a distinct tribe, under the name of *Ephemereæ*; but, considered as to the *sum* of their characters, I apprehend they must be united to *Funariaceæ*. The transition to recognized members of the latter family is in fact so gradual that it is impossible to indicate where the break should be made. *Ephemerum patens*, for example, is undistinguishable except by very minute examination from *Aphanorhegma serrata*, Sullivant (in Gray's 'Manual of the Botany of the Northern United States,' p. 647), which on its side is scarcely generically distinct from *Physcomitrium*. And if, by the almost universal consent of bryologists, *gymnostomous* mosses are no longer to form a separate tribe, but are to be distributed among those peristomatous tribes and genera to which they have in all their other characters a perfect affinity, why should we accord a greater favour to *astomous* mosses, which repose on an equally *negative* character for their separation? In other words, if there be no acknowledged tribe of *Gymnocarpi*, why should there be one of *Cleistocarpi*? This query is rendered more unanswerable by the consideration that as there are individual mosses (e. g. *Encalypta vulgaris*) which unite in themselves the characters of *Gymnostomi* and *Peristomati*, so there are other individuals which equally unite the characters of *Gymnostomi* and *Astomi*; I need only instance *Phascum rostellatum*, Brid., which has in some instances a *persistent*, in others a *deciduous* operculum, and is thus in itself both *cleistocarpous* and *stegocarpous*: if the former be considered its normal condition, it should be (according to our existing artificial systems) a *Phascum*; if the latter, a *Hymenostomum*!

I may in this place take occasion to remark on the very great rarity of Phascoid and other *annual* mosses in the Pyrenees. *Above the montose zone, I did not observe a single annual moss*, for *Funaria hygrometrica* cannot strictly be considered such. There is the same peculiarity in arctic countries, as for instance in Lapland, where according to Wahlenberg the *Phasca* and the smaller species of *Tortula* and *Gymnostomum* (i. e. *Pottia*) are altogether wanting! Contrast with this the following list of *Phasca*, abundant in cultivated ground near Montpellier in the autumnal and early winter months, which I owe to the kindness of Mr. Bentham: *Phascum axillare*, *bryoides*, *carniolicum*, *crispum*, *curvicollum*, *cuspidatum*, *Flærkeanum*, *muticum*, *pachycarpum* and *rectum*.

Tribus 17. SPLACHNACEÆ, Bryol. Europ.

33. *Tayloria*, Hook.

205. *T. serrata*, Hedw. Spec. Musc. t. 8 (sub *Splachno*); Br. Europ. *Tayloria*, p. 6. t. 1; M. P. 156.

Hab. Z₃ P. c. in monte *Crabioules* et ad lacum *Espingo*, juxta pastorum tuguria, terrestres.

Var. γ. *tenuis*, Br. Europ. l. c. t. 2; M. P. 157. *Splachnum tenue*, Dicks. Cr. Fasc. 2. p. 2.

Hab. Z₂ P. occ. supra ligna putrida in valle *Jéret*.

34. *Dissodon*, Grev. et Arnott.

206. *D. Frælichianus*, Hedw. Musc. Frond. 3. p. 99. t. 40 (sub *Splachno*).

Hab. Z_4 in terra humida P. centr. locis *Cirque d'Arbizon* (Philippe!) et ad latus boreale montis *Pic du Midi* dict. (De Lugo!)

Tribus 18. *POTTIACEÆ*, Br. Europ. (ex parte).

35. *Acaulon*, C. Muell. in Bot. Zeit. 1847, p. 99.

207. *A. muticum*, Schreb. (sub *Phasco*); Br. Europ. *Phascum*, p. 8. t. 2.

Hab. Z_{0-1} P. occ. et c. ad terram, sed rarius. *St. Sever. B.-de-Bigorre*.

As I have above considered it expedient to place *Ephemerum* in *Funariaceæ*, on the same principle *Acaulon* and its allies (*Phascaceæ*, C. Muell., excluding *Ph. crispum*, *multicapsulare*, *polycarpum* and *rostellatum*, which belong to *Weisiaceæ*) must go into *Pottiaceæ*. The near affinity of *Pottia minutula* to *Phascum cuspidatum*, &c. is too obvious to require proof; and as there are some *Phasca* (e. g. *Ph. bryoides*) which have an easily separable, not to say deciduous lid, there would seem to be no character, either natural or artificial, sufficiently constant to justify the separation of the latter from *Pottiaceæ*.

36. *Phascum*, Linnæus.

208. *Ph. cuspidatum*, Schreb. de Phasco, p. 8. t. 1; Br. Europ. *Phascum*, p. 12. t. 6; M. P. 322.

Hab. Z_1 in campis incultis prope *B.-de-Bigorre*, rarum.

37. *Pottia*, Ehrhart.

209. *P. truncata*, Hedw. Musc. Frond. 1. p. 13. t. 5 (sub *Gymnostomo*); Br. Europ. *Pottia*, t. 4.

Hab. Z_{0-1} locis cultis, ruderalis, &c.

38. *Anacalypta*, Roehling.

210. *A. latifolia*, Web. et M. B. T. p. 147 (sub *Grimmia*); Br. Europ. *Anacalypta*, t. 4.

Hab. Z_4 P. c. in altioribus montis *Pic du Midi de Bagnères* (Philippe!).

211. *A. Starkeana*, Hedw. Musc. Frond. 3. p. 83. t. 34 (sub *Weisia*); Br. Europ. *l. c.* t. 1.

Hab. Z_{0-1} P. c. in solo calcareo juxta thermas dict. *de Salut* prope *B.-de-Bigorre*.

Var. β . *brachyodus*, Br. Europ. (*Weisia affinis*, Musc. Brit. p. 79. t. 14).—*Hab.* P. occ. in arenosis prope *St. Sever*.

212. *A. lanceolata*, Hedw. Musc. Frond. 3. p. 66. t. 23 (sub *Leersia*); Br. Europ. *l. c.* t. 2.

Hab. Z₁ P. c. locis ruderatis secus ripas fl. *Adour* supra *Bagnères* ! (Philippe !). Nusquam alias nobis nota.

39. *Desmatodon*, Bridel.

213. *D. latifolius*, Hedw. Musc. Frond. 1. t. 30 (sub *Dicrano*) ; Br. Europ. *Desmatodon*, p. 5. t. 1 ; M. P. 158.

Hab. Z₃₋₄ in alpinis, terrestres. P. occ. *V. de Combascou*. P. c. *Port de Bénasque* ; *Pic du Midi* (Philippe !). P. or. *V. d'Eynes* (Montagne !) ; *Canigou*, *Cambrédazes* et *V. d'Eynes* (Arnott !).

Var. β . *muticus*, Brid. ; Br. Europ. ! l. c. t. 2 ; M. P. 159. *D. glacialis*, Funk.

Hab. Z₄₋₅ in summis *Pyrenæis*. *Port de Caunterets*. *Esquierry*.

214. *D. nervosus*, H. et T. ! Musc. Brit. p. 115. t. 20 (sub *Didymodonte*) ; Br. Europ. l. c. p. 6. t. 3 ; M. P. 160.

Hab. Z₁ P. c. in rupibus argillaceo-schistosis subdecompositis prope pagum *Loucrup*, non longe a *B.-de-Bigorre*, ubi am. Philippe detexit. P. or. ad viam quæ ducit a *Seo d'Urgel* ad *Andorram* (Arnott !) ; apud *Concampa* et ad *Pla de Sorroco* prope *Prats de Mollo* (Montagne !).

Tribus 19. TRICHOSTOMACEÆ, Bryol. Europ.

40. *Tortula*, Hedwig.

Obs. The following species were observed only on calcareous rocks or soil, or on mortar in walls : *T. rigida*, *aloides*, *chloronotos*, *tortuosa*, *inclinata*, *squarrosa* and *paludosa*. Above the region of forests only two species were seen, viz. *T. aciphylla* and a var. of *T. vinealis*.

§ 1. ALOIDEÆ, Bryol. Europ.

215. *T. rigida*, Schultz. Recens. Gen. *Barbulae* et Syntr. t. 32. fig. 1 (sub *Barbula*) ; M. P. 161 ; Br. Europ. *Barbula*, p. 13. t. 1. *T. enervis*, H. et Grev. in Brewst. Journ. 5. P. 1. p. 288.

Hab. Z₁ in terra calcarea, frequens. *Les Eaux Chaudes* ; *Gavarnie* ; &c.

216. *T. ambigua*, B. et S. ! Br. Europ. *Barbula*, p. 14. t. 2 ; M. P. 162.

Hab. Z₀ P. occ. in aggeribus subhumidis *St. Sever*.

217. *T. aloides*, Koch in Brid. Br. Univ. 1. p. 816 (sub *Trichostomo*) ; M. P. 163 ; Br. Europ. *Barbula*, p. 15. t. 2. *Tortula rigida*, Turn. ; H. et T. ! Musc. Brit. p. 53. t. 12.

Hab. Z₀₋₁ P. occ. et c. in aggeribus calcareis circa *B.-de-Bigorre*, &c.

§ 2. CHLORONOTÆ, Bryol. Europ.

218. *T. chloronotos*, Brid. Mant. Musc. p. 90, et Br. Univ. 1. p. 539 (sub *Barbula*). *T. membranifolia*, Hook. Musci Exotici, t. 26 ; M. P. 164. *Barbula membranifolia* et *chloronotos*, Br. Europ.

Hab. Z_{0-1} P. occ. in declivibus calcareis prope *Bilhères*, ad viam quæ ducit a *Pau* ad Bayonnam. P. c. ad pagum *Pouzac* (Philippe !). P. or. *Trancade d'Ambouilla* (Arnott !). "In Pyrenæis orientalibus et monte Serrato Cataloniae ubi in terra ochracea primi legimus;" Bridel, *l. c.*

I have never been able to perceive the differences between *T. chloronotos* and *membranifolia* insisted on in 'Bryol. Europæa' (*Barbula*, p. 18), and specimens of the former communicated by M. Schimper from Avignon have the *inflorescence monoicous*, the stem branched and the *leaves membranous at the apex*, precisely as in *T. membranifolia*. In these specimens, as in Arnott's, Philippe's, and my own from *Bilhères*, besides there being axillary male flowers on the fertile plants, there are also *separate male plants* with terminal flowers; but I have seen no specimen of *T. chloronotos* with a truly dioicous inflorescence.

§ 3. CUNEIFOLIÆ, Bryol. Europ.

219. *T. cuneifolia*, Dicks. Crypt. Fasc. 3. p. 7 (sub *Bryo*); M. P. 165; Br. Europ. *Barbula*, p. 31. t. 17.

Hab. Z_0 P. occ. in terra argillaceo-arenosa circa *St. Sever*: sociis *Funaria convexa* et *Muehlenbergii*.

220. *T. canescens*, Mont. Archives de Bot. t. 1. p. 133; M. P. 166; Br. Europ. ! *Barbula*, p. 34. t. 19.

Hab. Z_{0-1} P. occ. *Landes de Mugriet*, in solo arenoso. P. c. in rupibus schistosis prope *B.-de-Bigorre* et *Loucrup*. P. or. apud Illiberim in agro Ruscinonensi (Montagne).

221. *T. marginata*, B. et S. Br. Europ. *Barbula*, p. 33. t. 19.

Hab. Z_1 P. or. prope *Corbières*, loco *hermitage de St. Antoine de Galamus* (Montagne, *l. c.* sub nom. *T. cæspitosa*, H. et G.). P. occ. in muris prope *Cauterets*.

222. *T. muralis*, L. Sp. Pl. p. 1581 (sub *Bryo*); M. P. 167; Br. Europ. *l. c.* p. 35. t. 20.

Hab. Z_{0-3} in muris saxisque.

§ 4. RURALES, Bryol. Europ.

223. *T. ruralis*, L. Sp. Pl. p. 1581 (sub *Bryo*); Br. Europ. *l. c.* p. 42. t. 27.

"Var. 1, foliis patulis nec squarroso-recurvis;" M. P. 168. *Barbula ruralis* β . *rupestris*, Br. Europ. *Syntrichia intermedia*, Brid. ! Br. Univ. 1. p. 586.

Hab. Z_{0-1} in calce arenato murorum prope *Pau*.

This form, which, as the authors of 'Br. Europ.' remark, is found only on a calcareous matrix, is sometimes scarcely larger than *T. muralis*, and its habit is very different from that of the larger, ordinary form of *T. ruralis*; yet it seems impossible to separate it specifically. I have the same form from Dr. Grateloup, gathered near

Bordeaux, and from Dr. Arnott gathered at Avignon, Vaucluse and Restinclières. It matures its fruit in the very early spring.

“Var. 2, foliis acutioribus nonnunquam acuminatis;” M. P. 169.—*Hab.* Z_{1-3} locis editioribus secus rivulos, saxatilis. *V. de Combascou*; *Gavarnie*; &c.

224. *T. aciphylla*, B. et S. ! Br. Europ. *Barbula*, p. 42. t. 26; M. P. 170.

Hab. Z_{3-4} P. occ. et c. locis saxosis secus ovilia ad basin montis *Maladetta*; in valle *Combascou*, &c. *Vallon d'Arise* (Philippe!).

In the Pyrenees, as in the Alps, this occupies the highest region of pasturage, and is never found away from the summer habitations of men and cattle.

225. *T. lævipila*, Brid. Mant. Musc. p. 98 (sub *Syntrichia*); Br. Europ. l. c. t. 25.

Hab. Z_{0-1} ad arborum truncos.

226. *T. papillosa*, Wils. ! mst.; Spruce in Lond. Journ. of Bot. 4. p. 193; M. P. 171.

Hab. Z_1 P. occ. in arboribus nemoris *Parc de Pau* dicti.

227. *T. latifolia*, Bruch !; Bryol. Europ. l. c. p. 41. t. 24; M. P. 172.

Hab. Z_1 P. occ. locis humidis circa *Jurançon*, ad arborum radices.

§ 5. SUBULATÆ, Bryol. Europ.

228. *T. mucronifolia*, Brid. Mant. Musc. p. 97 (sub *Syntrichia*); Br. Europ. ! l. c. p. 38. t. 23.

Hab. “in Pyrenæis orientalibus” (Bridel, l. c.); *Mont Louis* (Arnott!).

229. *T. subulata*, L. Sp. Pl. p. 1581 (sub *Bryo*); M. P. 173; Br. Europ. l. c. p. 36. t. 21, 22.

Hab. Z_{0-4} ad terram, passim.

Var. β . *inermis*, Brid. Br. Univ. 1. p. 581. *T. inermis*, Mont. Arch. de Bot. 1. p. 136. t. 4.—*Hab.* “ad Notre Dame de Peña in agro Ruscinonensi;” (Montagne, l. c.)

This is quite possibly a distinct species, as Dr. Montagne still maintains, but as I have seen only barren specimens of it, gathered by Dr. Arnott at Vaucluse, I confess myself unable to form a decided opinion.

§ 6. CONVOLUTÆ, Bryol. Europ.

230. *T. convoluta*, Hedw. Musc. Frond. 1. t. 32 (sub *Barbula*); M. P. 174; Br. Europ. l. c. p. 29. t. 16.

Hab. Z_{0-1} in terra et muris, haud vulgaris.

“Var. *fragilifolia*, foliis multo longioribus, linearibus, patulo-recurvis, alis undulatis, perichætii laxioris acuminatis;” M. P. 175.—*Hab.* P. occ. in muris pagorum *Jurançon* et *Bilhères*.

§ 7. REVOLUTÆ, Bryol. Europ.

231. *T. revoluta*, Brid. in Schrad. Journ. Bot. 1800; Br. Europ. *l. c.* p. 27. t. 14; M. P. 176.

Hab. Z₀₋₁ cum n. 230, multo autem copiosior.

§ 8. TORTUOSÆ, Bryol. Europ.

232. *T. tortuosa*, L. Sp. Pl. p. 1583 (sub *Bryo*); Br. Europ. *l. c.* p. 26. t. 13; M. P. 177.

Hab. Z₁₋₃ in muris saxisque calcareis, copiosissima et pulcherrime fructifera; rarius ad arbores vetustas.

The cellules of the leaf are minutely papillose, and when viewed from above each marginal cellule usually shows two *salient* papillæ: it is this which gives the edge of the leaf the appearance of being granulated. Is it caused by the pressure of the grains of chlorophyll on the delicate walls of the cellules?

233. *T. inclinata*, Schwgr. Suppl. t. 33 (sub *Barbula*); Br. Europ. *l. c.* p. 25. t. 12; M. P. 178.

Hab. Z₁ P. occ. et c. in muris rupibusque calcareis, haud infrequens. *Les Eaux Chaudes. Rontignon. B.-de-Bigorre, &c.*

234. *T. squarrosa*, De Not. Specim. de Tort. Ital. n. 31; Spruce in Lond. Journ. of Bot. 4. p. 193; M. P. 179; Br. Europ. fasc. 31. p. 1. t. 1.

Hab. Z₁ in collibus calcareis prope *Jurançon* et *B.-de-Bigorre. Pic St. Loup* prope *Montpellier* (Arnott!).

235. *T. cæspitosa*, Schwgr. Suppl. t. 31 (sub *Barbula*); M. P. 180; Sullivant! Musci Allegh. n. 150. *Barbula cirrhata*, Bryol. Europ. *l. c.* p. 24. t. 11.

Hab. Z₂ P. occ. supra ligna putrida in faucibus inter pagum *Penticosa*, et balneas ejusdem nominis, in Aragonia: rarissima.

§ 9. UNGUICULATÆ, Bryol. Europ.

236. *T. unguiculata*, Hedw. Musc. Frond. 1. t. 23 (sub *Barbula*); M. P. 181; Br. Europ. *Barbula*, p. 19. t. 5.

Hab. Z₀₋₁ in muris, &c., frequens; in rupibus ophiticis loco *Gorge de Labassère*.

237. *T. paludosa*, Schwgr. Suppl. t. 30 (sub *Barbula*); M. P. 182; Br. Europ. *l. c.* p. 21. t. 7.

Hab. Z₁₋₂ in rupibus udis calcareis regionis fagorum, sat frequens. *Gorge de Hourat* prope *les Eaux Chaudes; Mt. Lhieris, &c.* Nusquam in *paludibus* vidi!

238. *T. gracilis*, Schwgr. Suppl. t. 34 (sub *Barbula*); Br. Europ. *l. c.* p. 22. t. 8.

Hab. in Pyrenæis orientalibus (Bridel, Br. Univ. 1. p. 537).

239. *T. fallax*, Hedw. Musc. Frond. 1. t. 24 (sub *Barbula*); M. P. 183; Br. Europ. *l. c.* p. 23. t. 9.

Hab. Z₀₋₂ in rupestribus subhumidis.

240. *T. vinealis*, Brid. Br. Univ. 1. p. 830 (sub *Barbula*) ; Br. Europ. *l. c.* p. 24. t. 10.

Var. β . *flaccida*, Br. Europ. ; M. P. 184.—*Hab.* Z_1 P. c. ad ripas rivuli qui ad monasterium *Médous* prope *B.-de-Bigorre* originem suam habet.

Var. *nivalis*, M. P. 185.—*Hab.* Z_4 in rupibus frigidis ab aqua nivali irrigatis vallis alpinae *Esquierry* dictæ.

This second variety forms large compact tufts on the ledges of dripping rocks, growing near *Senecio Tournefortii*, *Euphrasia minima* and *Luzula spadicea*. The stems attain a length of 6 or 8 inches, and are clad throughout with leaves of a deep reddish brown. Hence its aspect is very different from that of the ordinary form of *T. vinealis*, but without the fruit I do not venture to separate it.

41. *Didymodon*, Schwgr. (*ex parte*).

241. *D. rubellus*, Hoffm. Deut. Fl. 2. p. 33 (sub *Bryo*) ; Br. Europ. *Didymodon*, p. 3. t. 1 ; M. P. 186. *Weisia curvirostra*, H. et T. ! Musc. Brit. p. 84. t. 14.

Hab. Z_{0-2} in muris, rupibus, &c.

242. *D. cylindricus*, Bruch in Brid. Br. Univ. 1. p. 806 (sub *Weisia*) ; Br. Europ. *l. c.* p. 5. t. 3 ; M. P. 187.

Hab. Z_2 P. occ. in saxis rivulorum supra thermas dict. *les Eaux Bonnes* ; P. c. in vicinia *B.-de-Luchon*, frequens, locis *Superbagières*, *Lac de Séculéjo*, *Cascade du Cœur*, &c.

42. *Trichostomum*, Hedwig.

Obs. *T. flexicaule* is the only species of this genus which seems absolutely confined to calcareous rock : *T. mutabile*, *crispulum* and *trophaceum* were observed on no other rock in the Pyrenees, but in England I have occasionally seen them in habitats where no trace of carbonate of lime was to be detected. The last five species form part of the genus *Leptotrichum* of Hampe, and are placed by C. Mueller in his tribe *Leptotrichaceæ* (Conf. Syn. Musc. p. 415).

§ 1. CRISPULA.

243. *T. mutabile*, Bruch mst. ; Br. Europ. *Trichostomum*, p. 8. t. 5 ; M. P. 188.

Hab. Z_1 locis calcareis. P. occ. ad pagum *Narcastet*. P. c. in rupibus umbrosis prope *B.-de-Bigorre* (*Chemin de Labassère* et *Bains de Salut*). An revera a sequente distincta species ?

244. *T. crispulum*, Bruch et Muell. in Regensb. Bot. Zeitung, 1829 ; Br. Europ. *l. c.* t. 4 ; M. P. 189. *Didymodon Benthamii*, Arnott ! in Edinb. New Philosoph. Journ. 1846.

Hab. Z_1 in rupibus calcareis irroratis Pyren. occidentaliū, frequens. *Pau* ; *Narcastet*, &c. *Restinclières* prope *Montpellier* (Arnott !).

“Var. foliis acumine subrecto;” M. P. 190. (Medium inter vars. β . et γ . Br. Europ.)—*Hab. Vallée d'Ossau* prope pagos *Louvie* et *Jurançon*.

§ 2. RIGIDULA.

245. *T. tophaceum*, Brid. Mant. Musc. p. 84; Br. Europ. *l. c.* p. 9. t. 6; M. P. 191.

Hab. Z_1 P. c. ad mortarium in muris subhumidis pagi *Loucrup*, non longe a *B.-de-Bigorre*. P. or. “ad *St. Antoine de Galamus* cum *Tortula marginata*, nec non prope turrim nomine *La Massane* insignitam” (Montagne, *l. c.*).

246. *T. luridum*, Hsch. (sub *Cynodonte*); M. P. 192. *Didymodon luridus*, Br. Europ. *Didym.* p. 4. t. 2.

Hab. Z_1 P. occ. in calcareis subhumidis prope *Pau*: socio *Tortula chloronoto*. Prope *Burdigalam* (*Grateloup*!).

247. *T. rigidulum*, Hedw. Musc. Frond. 3. t. 4 (sub *Didymodonte*); Br. Europ. *Trichostomum*, p. 10. t. 7; M. P. 193.

Hab. Z_{1-2} in muris rupibusque tum siccis tum humidis, frequens. *Vallées de Castelloubon* et *d'Ossau*; *Luz*; *Mt. Lhieris*, &c.

§ 3. GLAUDESCENTIA.

248. *T. glaucescens*, Hedw. Musc. Frond. 3. t. 37; Br. Europ. *l. c.* p. 18. t. 15; M. P. 194.

Hab. Z_{2-4} in rupium fissuris. P. occ. in vallibus *Combascou* et *Jéret*. P. c. *Lac de Séculéjo*; *Lac Lehou* (Philippe!). P. or. *Mt. Louis* et *V. d'Eynes* (Arnott!).

§ 4. SUBULATA (= LEPTOTRICHUM, Hampe).

249. *T. tortile*, Schrad. Crypt. Gewäsehe, n. 49; Br. Europ. *l. c.* p. 14. t. 10; M. P. 195.

Hab. Z_{0-2} in sylvaticis *Pyrenæorum* totorum ut et *Agri Syrtici*: terrestre. *V. du Lys*; *St. Pandelon de Dax*, &c.

250. *T. homomallum*, Hedw. Sp. Musc. t. 23 (sub *Didymodonte*); Br. Europ. *l. c.* p. 16. t. 2; M. P. 196.

Hab. Z_{0-2} in umbrosis humidis ad terram.

251. *T. flexicaule*, Schwgr. Suppl. t. 29 (sub *Cynodontio*); Br. Europ. *l. c.* p. 15. t. 11; M. P. 197.

Hab. Z_1 locis calcareis, semper absque fructu.

252. *T. pallidum*, Hedw. Musc. Frond. 1. p. 71. t. 27; Br. Europ. *l. c.* p. 18. t. 14.

Hab. Z_{0-1} in arenosis umbrosis. P. occ. circa *Dax* (Thore, *Grateloup*). P. c. *B.-de-Bigorre*! (Philippe!). P. or. *Concampa* (Arnott!).

253. *T. subulatum*, Bruch! in *Salzman Pl. Tingit.*; Br. Europ. *l. c.* p. 17. t. 13; M. P. 198. *Didymodon aureus*, De Not. Syll. Musc. p. 190.

Hab. Z₀ P. occ. ad aggeres arenosos umbrosos circa *St. Sever*, copiose et pulcherrime!

43. *Distichium*, Bryol. Europ.

254. *D. capillaceum*, Hedw. Musc. Frond. 2. t. 26 (sub *Swartzia*); Br. Europ. *Distichium*, p. 4. t. 1; M. P. 199.

Hab. Z₁₋₄ in rupibus udis præsertim calcareis, frequens.

255. *D. inclinatum*, Hedw. Musc. Frond. 2. t. 27 (sub *Swartzia*); Br. Europ. l. c. p. 5. t. 2; M. P. 200.

Hab. Z₃₋₄ P. c. in rupibus micaceis juxta lacum alpinum dict. *Lac Lehou*; nec non in valle alpina *Esquierry*: rarissimum.

[To be continued.]

XL.—*Observations on the recent Foraminifera*.

By WILLIAM CLARK, Esq.

To the Editors of the Annals of Natural History.

GENTLEMEN,

Norfolk Crescent, Bath, Feb. 22, 1849.

I HAVE for many years employed myself in malacological pursuits, and had opportunities of observing some of the recent Foraminifera, particularly those of the coralline zones of the South Devon coasts.

As long ago as 1834-5, my friend Mr. Jeffreys of Swansea, who by his extensive researches throughout the British Isles for new and rare Testacea has rendered eminent services in promoting conchological and malacological science, was on a visit to me at Exmouth, during which we had frequent disquisitions on the nature of those minute organisms which at that time were termed Cephalopoda; I then strenuously advocated that they belonged to the coralline group, and were of course polypiferous, and that I believed them, in their natural habitats, to be fixed, similarly to the great mass of Zoophytes; these views, except on the point of fixity, have been fully corroborated by M. Ehrenberg's observations, and during the last summer, 1848, I was enabled, by the occurrence of very recent specimens of *Orthocera Legumen*, to ascertain some new facts relative to these foraminiferous polypes. It has been, I believe to this day, a matter of doubt, if they have at the anterior end tentacular filaments, and as proof in the affirmative, in *Orthocera Legumen*, I have specimens in which the dried linear cilia, about eight, are distinctly to be seen lying radiated in the external sulci of the striulæ of the aperture, and I have little doubt that the creature can withdraw them within the internal hollows of the striæ.

As to the other organs of *O. Legumen*, I could only observe in the two or three anterior cells, a dried, perhaps in life, a pulpy mass, apparently inclosed in a membranous sac of a brown colour, but in the posterior chambers there were scarcely any traces of this substance, as these appeared to be nearly transparent; it may also be presumed that the membranous sac contains the viscera.

The constructor of the calcareous cells of *O. Legumen*, which communicate with each other by constricted orifices, seems not to be an animal with lobes, deposited in the chambers, or an aggregation of polypes linked together, with a common canal for reproduction, sustentation and depuration, but a solitary being produced from a gemma, cast by the parent on a marine substance, which, springing therefrom, constructs the first cell, in which it lives and dies, having previously by gemmation produced its successor, the architect of the second cell, and so on, until nature has completed the appointed number.

These inferences arise from the brown membrane, or mantle, or pulp, not being visible in any other than the two or three anterior chambers; the matters which were originally in the posterior, or first cells, probably more hyaline, appear to be lost by collapse and desiccation of the animal.

I have also removed by acids the calcareous cases of many others of the Foraminifers, and they have nearly presented the same appearances that have just been stated; from this it would appear that the live polype is only to be found in the last cell, those of the preceding ones having each perished as soon as it had produced the germ of its successor.

The branchial organs are probably those minute delicate filamentary points observed by M. Ehrenberg and others, and are perhaps capillary prolongations of the membranous sac or mantle, and serve for the aëration of the circulating fluid as well as for effecting the formation of the calcareous case: that these communications with the animal through the foramina have not been discovered in the membrane investing it cannot be a matter of surprise, when its minuteness and tenuity are considered, and the examinations being made, if not in a completely dried state, at least in conditions of great collapse.

These filaments have been considered as spurii pedes, and subservient to locomotion; this idea I shall prove by and by to be erroneous, by showing that the *Orthocera*, and beyond doubt, some of the *Lagenæ*, are fixed to marine substances by a posterior mucronal style; and I believe that the rest of the Foraminifera, when in their natural habitats, are fixtures.

The contents of cabinets are composed of detached substances found in coral sand, with their characters usually lost by continual

attrition, and very often are imperfect fragments, which have passed for perfect organisms, as I shall presently demonstrate.

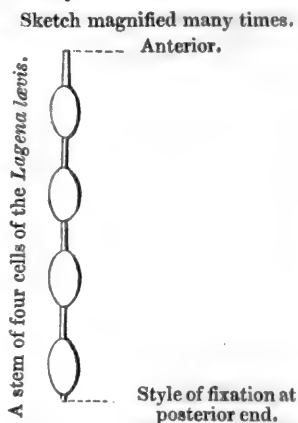
The *Orthocera* are fixed by the subulate style at the posterior end, though most cabinet specimens are broken off and rounded by the corally particles and agitation of the waters.

Many of the *Polystomellæ* and other discoid forms have, when perfect, a spiny periphery, by which they are permanently fixed to marine objects, and in this state I have often seen the *Polystomella crista*, but when detached the spines fall off, or are worn away. The *Rotalia Beccarii* adheres by its concave surface. The *Lobatula vulgaris*, every one knows, is attached to stones, shells and zoophytes; and why should not the rest of the Foraminifers be in a similar category?

But the decisive proof that most of these calcareous structures are naturally fixtures, will be manifest from the sketch of the configuration of the *Lagena lævis*. This organism, in a state of nature, is never in distinct flask or urn-shaped portions, unless the incipient or primary cell is met with: the real structure is, that these flask-shaped forms are the cells of a Foraminifer superincumbent on each other, and permanently united: to what number they amount to, when in a perfect state, I cannot say, but I *have seen*

a stem of at least four united cells, the posterior one being furnished with the style of attachment. All naturalists have hitherto figured this foraminiferous form in broken fragments, which they have considered to be perfect, distinct and separate forms, likening them to an oil-flask or urn, with the neck margined at what they thought was the terminal orifice, whereas these flask-shaped cells are only portions of a stem of chambers, which from the extreme delicacy of structure are broken by the slightest touch, at the neck, usually bringing away with it a small circular portion of the bulb of the preceding cell, giving the neck the appearance of a margin which is smoothed by attrition. As to the polype of the *Lagenæ*, I can say nothing more than what I have stated with respect to *O. Legumen*. Finally, I may observe, that there is little doubt that all the species of these minute organisms are foraminiferous, and inhabited by polypiferous creatures.

It may perhaps be thought, that in my observations on the polype of the Foraminifers I have stated hypotheses instead of facts; but it must be recollected that in the obscure and difficult points of natural history, this mode of searching out truth must be submitted to as the best the case admits of, and it is often a



very efficient aid by exciting discussion. On these natural phenomena we cannot at once apply mathematical demonstration, but must be content to obtain facts, and arrive at truth by inductions, in the first instance, from hypothesis.

I am, Gentlemen, your most obedient servant,

WILLIAM CLARK.

P.S.—Since the above observations were written I have examined a great number of the *Lagena striata*, and have no doubt that, like the *Lagena lævis*, they form in their natural habitat, a fixed stem of cells piled on each other.

XLI.—*On the Animal of Kellia rubra*.

By JOSHUA ALDER, Esq.

To Richard Taylor, Esq.

DEAR SIR,

Newcastle-on-Tyne, April 18, 1849.

CAN you spare me room in the next Number of the 'Annals' for a few remarks on Mr. Clark's interesting letter on *Kellia rubra*?

I am glad to find that Mr. Clark is enabled to confirm my statement that the anterior tube of this species is an open fold of the mantle: the only difference now between us is as to its uses, involving the question of the mode of supplying a current of water for respiratory and alimentary purposes.

In cases where a matter of fact is in dispute, it is always best, before arguing the point, to test the truth of former observations. On reading Mr. Clark's letter, therefore, I resolved, as he had done, to submit this little bivalve to a re-examination; and accordingly applied to my friend Mr. Cocks of Falmouth to send me a few specimens by post, as it is rather difficult to procure on our part of the coast. Mr. Cocks very obligingly and promptly complied with my request by sending me above a hundred specimens, which, after a land journey of nearly 500 miles, arrived quite fresh, and immediately showed signs of life on being put into sea-water. I placed two or three of these in a watch-glass under the microscope, and examined them by transmitted light, the mode I had before employed with success to observe the currents in this species as well as in *K. suborbicularis*. By this means I distinctly saw, as on former occasions, a continuous current of water flowing into the anterior tube; indicated by the minute floating particles it contained, which were gradually drawn towards the tube, and one after another passed into it in quick succession. In this manner I examined many individuals, and always with the same results. When the water is perfectly clear

its motions cannot be observed, and it is therefore necessary to have some minute floating matter contained in it; but this is always the case in water obtained fresh from the sea, though it may appear pure to the naked eye. The next thing to ascertain was, whether a current of water passed in by any other channel. For this purpose I examined carefully the circumference of the mantle, but found no indication of an ingress-current at any other part. The floating particles in the water remained perfectly stationary, with the exception that an egress-current was occasionally seen to proceed from the posterior orifice: but this was more difficult to detect than the ingress-current, probably because the floating matter appeared to be all detained and appropriated, and partly because the flow was not continuous, occasioned by the alternate opening and closing of the aperture as is usual in the excretory siphon. In two or three cases I saw a current issuing from this orifice very distinctly, but never one entering it. In another instance where a delicate filament of extraneous matter was attached to the edge of the aperture, its vibratory motion showed the presence of a current which I could not otherwise detect; but this filament was always deflected outwards, and was never drawn towards the fissure, as would have been the case had an alternate current set in in that direction.

We shall now turn to Mr. Clark's observations. As Mr. Clark does not say that he has *seen* the currents of water in any instance, I infer that his conclusions are drawn from the appearance and motions of the parts only, which in all cases he states very correctly. Mr. Clark considers that the only use of the anterior tube-like fold is to assist the foot in progression. I do not exactly understand how this is to be accomplished, nor is its mode of operation distinctly explained. The tube is indeed partially withdrawn at the same time that the foot is contracted,—that is, while the body is drawn forward,—but this appears to be more easily and satisfactorily explained by supposing that the withdrawal of the tube at each step is for the purpose of regulating the admission of water while the body is advanced. These parts are known to be extremely sensitive, and contract on the slightest external motion. But Mr. Clark thinks he has discovered that the supply of water for the branchiæ is received and expelled by the same aperture—the posterior one—in the manner of systole and diastole. To this I would reply, that such a supposition is contrary to the known œconomy of the bivalves, in which the inhalant is always kept distinct from the exhalant current, and admitted by a separate aperture from that by which the latter is expelled. This seems to be necessary, as the currents, being caused by the motion of the branchial cilia, and not by the expansion and contraction of the walls of a cavity, are continuous

in one direction, and the passing in of one portion of water is consequent on the displacement and passing onwards of another portion, so that both processes are going forward at the same time. The two apertures are always present in those genera where the mantle is more or less closed, though one of them is sometimes confluent with the pedal opening. They are usually siphonal, and have been called the branchial and anal siphons; a mode of appellation not altogether correct, as both are alike subservient to branchial and alimentary purposes; the one (inhalant) being branchial and buccal; the other (exhalant) branchial and anal. In the former the current is pretty regularly sustained; in the latter the water is usually expelled by an intermittent motion and occasionally by jerks. I should not have thought it necessary to be thus minute in detail did not Mr. Clark's arguments lead to the supposition that he takes the words branchial and anal, as applied to these apertures, in a literal and restricted sense, which they are not intended to bear. But to return to *Kellia rubra*: the contraction and expansion of the posterior orifice is no more than is seen in the excretory siphon of all bivalves, and has no power to produce the internal circulation, but merely to regulate the discharge, and in this case, where the orifice is a mere slit, the ejecting force is very limited. The situation of the anus, as pointed out by Mr. Clark, is no doubt correct, and in the usual place opening behind and within the egress-aperture. Mr. Clark, however, saw the points of the branchiæ within the fissure, which he seems to consider a proof of its being a branchial (ingress?) aperture. The branchiæ of this species are of a triangular form and very unequal in size, the lower angle extending down posteriorly very near to the orifice, but it does not enter it, and I think no conclusion can be drawn from this circumstance; at least, none that can be set against the evidence derived from the actual sight of the currents, which any one may obtain, especially the inhalant one, in the way that I have pointed out.

The superior size of *Kellia suborbicularis* renders it less liable to be misunderstood. Having frequently had this species alive for several days together, both before and after ascertaining the peculiarities of *Kellia rubra*, I am sufficiently familiar with it to speak confidently concerning its anterior siphon, which, as I have more than once stated elsewhere, is a perfect tube, closed below, through which the branchial current may be seen to enter. This is perhaps the only described species in which the tube is really perfect, for M. Deshayes was most likely deceived with respect to the Mediterranean *Kellia rubra* (*Bornia siminulum*) in the same manner that Mr. Clark and I had been on a first examination.

To reconcile the conflicting statements of authors, Professor E. Forbes has suggested that the open or close form of the tube

in this genus may be only a sexual distinction ; but this is disproved by an examination of the British species, where the peculiar form of each is constant in all the individuals that have been examined.

Before quitting the subject of *Kellia rubra* I wish to take the opportunity of mentioning that Dr. Turton was the first to point out the viviparous character of this species, which he announced in his 'British Bivalves,' p. 258, twenty-seven years ago.

I am, dear Sir, yours very truly,

JOSHUA ALDER.

XLII.—*Description of a bag-shaped, glandular apparatus on a Brazilian Bat, the Emballonura canina of Pr. Maximilian.* By J. T. REINHARDT.

DURING a recent sojourn in the Brazils I collected, in the interior of Minas Geraës, numerous specimens of a small species of bat (the *Emballonura canina*, Pr. Maxim.) which is there very common, and which attracted my particular attention from the fact of its having its wings provided with a small bag-like appendage similar to that noticed by Mr. J. E. Gray* and by Professor Krauss† in the species of *Saccopteryx*.

On my return to Europe, I saw, from the annual report of the natural history of the Mammalia for the year 1846 by Professor A. Wagner‡, that this organ had already been discovered on the very same species of bat by the late Dr. Natterer, and that the learned Professor had published drawings of it in his 'Beiträge zur Kenntniss der Säugethiere von America,' published in the 'Abhandlungen der Königl. Bayerischen Academie der Wissenschaften, V^{ter} Band, 1^{ste} Abth. 1847.'

Two figures (*loc. cit.* tab. 4. figs. 6 & 7) being all that is to be found in the above-named work, there being no description in the text, I have thought it right to publish my observations concerning this organ, which are founded on the examination of a large number of specimens, both alive and immediately after death.

On examining in the *Emballonura canina*, that part of the alar membrane which extends to the thumb, along the fore-edge of the upper and lower arm, we find on the back a fissure leading to a small cavity in the interior of the membrane, in which is secreted a reddish, greasy matter, of a strong, somewhat ammoniacal smell. The aperture is at a distance of about 3 lines from the insertion of the alar membrane on the back: the

* Ann. and Mag. of Natural History, vol. xvi. p. 279.

† Erichson's Archiv für Naturgeschichte, Band 1. p. 178. t. 6.

‡ Erichson's Archiv, 1847, B. 2. p. 13.

wing being spread, it has the form of a longitudinal fissure, 2 lines long, which extends immediately to the free outer edge of the membrane, is provided with thick lip-formed edges, and leads into a small cavity stretching itself along the margin of the alar membrane inwards to the body, becoming more and more narrow, and ending at length about $1\frac{2}{3}$ line from the fissure. The wing being extended, the two lips of the aperture glide from each other, so that the cavity opens; but when the wing is at rest or only half-extended, the innermost, that is to say, that lip which is nearest to the body, glides over the outer lip and thus covers it.

Besides this, the small bag is provided with particular muscles, on the contraction of which it must open; for in the alar membrane are seen fine muscular fibres, which run from the edges of the aperture in a parallel direction with the outer edge of the alar membrane, partly towards the body, partly towards the thumb. The interior surface of the bag is without folds or wrinkles.

On comparing the descriptions of the corresponding organ of *Saccopteryx* with the above-described glandular apparatus of the *Emballonura canina*, several material differences may be discovered: first, the bag of the *Saccopteryx* is somewhat differently situated, viz. just at the bending of the joint of the elbow, while in the *Emballonura canina*, as has already been mentioned, it is placed near the edge of the wing; further, the interior surface of the bag in the former is provided with several sharp folds or wrinkles immediately within the opening, which I have not found on the latter; finally, the bag of the *Saccopteryx* is much larger, and has the appearance of a sharply limited protuberance on the lower side of the wing, while in the *Emballonura canina* it is but slightly perceptible.

The males only of the *Emballonura canina* possess the above-described organ; in the females the bag-like cavity is totally wanting, but the lip-formed edges of the fissure exist in a rudimentary condition, being represented by two very fine and sharply limited folds of the skin, of which the largest (which corresponds to the inner lip) scarcely rises the eighth part of a line*. This glandular apparatus is no doubt one of the means by which the sexes are enabled to recognise each other; and it appears to me very probable, that in the *Saccopteryx* likewise, the bag will prove to be a sexual character, a supposition which may find some confirmation in the fact of the specimen described by Dr. Krauss being a male, and the same, if I am not mistaken, being the case with a specimen in the British Museum, which Mr. Gray kindly

* This rudimental state is, no doubt, the reason why it has not been observed by the Prince of Neu-Wied, who founded his description of this bat upon a single female specimen.

allowed me to examine during my short stay in London. This instance of a sexual glandular apparatus in the Cheiroptera does not however stand isolated, since the observations of the late Dr. J. Natterer have made us acquainted with a gland on the males of at least many species of *Dysopes*, provided with an opening, and situated on the throat.

Copenhagen, Sept. 1848.

XLIII.—On some Families and Genera of Corals. By WILLIAM KING, F.G.S. France.

Fam. CYATHOPHYLLIDÆ, Dana.

Gen. *Polycælia**, King.

A (?) simple Cyathophyllidia. *Form* conical. *Walls* solid. *Primary vertical plates* converging to within a short distance of the centre. *Secondary vertical plates* reaching about half way to the centre. *Transverse plates* horizontal, at irregular distances from each other, and extending quite across the cavity. *Chambers or lamellar interspaces* capacious compared with those of other Cyathophyllidias. *Reproduction* within the polypiferous cup.

Type, *Turbinolia Donatiana*, King, 'Catalogue of the Organic Remains of the Permian Rocks of Northumberland and Durham,' p. 6.

This genus differs from most *Cyathophyllidæ* in its structural characters; but it appears to be nearest related to *Cyathophyllum*, taking as its type the (?) tri-areal *C. plicatum* of Goldfuss, which is the first species described under the genus (vide 'Petrefacta,' pl. 15. fig. 12).

Fam. FENESTELLIDÆ, King.

Setting down as the type of *Fenestella* the *F. antiqua* of Lonsdale, it is proposed to place all those palæozoic genera in the present family agreeing with this genus in being reticulated, and having the cellules planted on a basal plate composed of vertical capillary tubuli as first discovered by Mr. Lonsdale. Besides the typical genus above-named, *Fenestellidæ* includes the *Polypora* and *Ptylopora* of Mr. M'Coy, and the two genera next to be described.

Gen. *Synocladia*†, King.

A foliaceous or frondiferous infundibuliform Fenestellidia. *Fronds* consisting of numerous connected stems or ribs. *Stems*

* Etym. πολὺς, many; κοῖλος, a cavity.

† Etym. σὺν, with; κλάδος, a branch.

bifurcating; radiating from a small root; running parallel to, and at a short distance from each other, on one plane; and giving off bilaterally numerous, short, simple branches, of which opposite pairs conjoin midway between the stems arcuately or at an ascending angle. *Branches* occasionally modified into stems. *Cellules* on the inner or upper surface of the fronds, on both stems and branches, imbricated, and distributed in longitudinal series. *Series of cellules* separated from each other by a dividing ridge. (?) *Gemmiferous vesicles* on the dividing ridges.

Type, *Retepora virgulacea*, Phillips: a Permian species.

Gen. *Phyllopora**, King.

A Fenestellidia, consisting of infundibuliform, folded, perforated fronds or foliaceous expansions. *Cellules* on the whole of the outer or under surface of the fronds, and planted more or less approximating to a position at right angles to the plane of the capillary-tubular basal plate. *Cellule-apertures* with plain margins, and parallel to the surface of the fronds.

Type, *Gorgonia Ehrenbergi*, Geinitz (= *Fenestella permiana*, King, Catalogue, p. 6).

Fam. THAMNISCIDÆ, King.

It is proposed to include in this family certain shrub-like genera of palæozoic ciliobrachiata corals possessing the bi-structural and polypidomial characters of *Fenestellidæ*, but having free stems and branches. It embraces the two following genera, and apparently Mr. M'Coy's *Ichthyorachis*.

Gen. *Thamniscus*†, King.

The typical Thamniscidia. *Stems* frequently and irregularly bifurcating more or less on one plane: celluliferous on the side overlooking the imaginary axis of the coral. *Cellules* imbricated, and arranged in quincunx. *Gemmiferous vesicles* overlying the cellule-apertures.

Type, *Ceratophytes dubius*, Schlotheim: a Permian species.

Gen. *Acanthocladia*‡, King.

A Thamniscidia. *Stems* symmetrically and bilaterally branched more or less on one plane, rarely bifurcating. *Branches* short, simple, occasionally elongated and becoming bilaterally branched. *Stems and branches* celluliferous on the side overlooking the imaginary axis of the coral. *Cellules* imbricated, and arranged in

* Etym. φύλλον, a leaf; πόρος, a perforation.

† Etym. θαμνίσκος, a little shrub.

‡ Etym. ἄκανθα, a spine; κλάδος, a branch: in reference to the spine-like branches of the coral.

longitudinal series. *Series of cellules* separated from each other by a dividing ridge. (?) *Gemmiferous vesicles* on the dividing ridges.

Type, *Ceratophytes anceps*, Schlotheim : a Permian species.

This genus, which differs from *Thamniscus* in its mode of branching and some other characters, is proposed for certain corals usually bearing the obsolete name *Glauconome*, proposed by Goldfuss for some species previously placed in *Vincularia* by De France.

Fam. ELASMOPORIDÆ, King.

This group agrees with *Escharidæ* in the structure of its polypidoms or cellules, but differs therefrom in being uni-lamello-celluliferous and reticulated. Only the following genus is known to the writer.

Gen. *Elasmopora**, King.

The typical Elasmoporidia, consisting of infundibuliform, folded, perforated fronds or foliaceous expansions, which are entirely celluliferous; the cellules opening on their inner or upper surface. *Cellules* arranged alternately, and running more or less parallel to the plane of the fronds; their front and dorsal walls forming the two faces of the fronds. *Cellule-apertures* approximating more or less to a position at right angles to the plane of the fronds, furnished with tubular and other processes on their inferior or projecting margin. *Gemmiferous vesicles* overlying the cellule-apertures. *Both surfaces of the fronds* foraminated. *Outer or under surface of the fronds* marked with distant waved lines, forming the boundaries of the cellules.

Type, *Millepora cellulosa*, Linnæus : a species occurring in the Mediterranean. An allied species (*Elasmopora Beaniana*, King) inhabits the British seas.

The type given above is usually placed in *Retepora* (= *Krusensternia*, Lamouroux, and *Frondipora*, Blainville); but this genus, considering the structure of its typical species, the *Millepora reticulata* of Linnæus, is not only distinct from *Elasmopora* in a generic point of view, but it evidently belongs to a different family group. *Elasmopora* externally resembles *Phyllopora*; but the want of a basal plate composed of vertical capillary tubuli in the former, and the presence of some important differential characters in the latter, completely and widely separate both genera from each other.

Further details on the foregoing groups and some of their species are given in the author's forthcoming monograph.

* Etym. ἔλασμα, a plate; πόρος, a perforation.

BIBLIOGRAPHICAL NOTICES.

Rare and Remarkable Animals of Scotland, represented from living Subjects; with Practical Observations on their Nature. By Sir JOHN GRAHAM DALYELL, Bart. Volume second, containing fifty-six coloured Plates. London: John Van Voorst, 1848. 4to.

WE have to apologize to our readers for our dilatoriness in introducing to their notice this second volume of a very remarkable work, whose speedy appearance we hail with much pleasure. The volume is equal to the first in its bulk and fair proportions, but scarcely equal in the interest and marvellousness of its histories; and indeed the author has been anticipated, if we mistake not, in the publication of his most curious discoveries, although certainly not in the finding of them. He has been long in the possession of a knowledge of certain phænomena touching the lives of these inferior animals, which, subsequently ascertained by younger investigators less patient of their gestation, got speedy air and publicity; and hence discoveries which are original in themselves and of singular interest, appear as second-hand and wanting in effect on their now publication. In illustration and proof of this we may instance the discovery of the metamorphosis of the compound and solitary Tunicata—their oviparous character—the tadpole similitude of their larvæ—their locomotive power and subsequent fixation—the diffidence of each larva on the foreign object to be its future residence—and its gradual mutation to the parent form. This discovery is here fully explained and illustrated from personal observation, and we know that it has been long the author's own; but naturalists have become familiar with it, not through his works, but through the popular writings of Milne-Edwards, translated and transferred into every work compiled to meet the demand for elementary books on zoology.

The first chapter treats of "Foliaceous Zoophytes," or *Flustra*. At the very outset Sir John tells us that each polype, in the multitudinous polypidom, lives "solely for itself, independent of the life, the death, and the circumstances of its nearest neighbour. Among the multitudes restricted to limited space, we discover no reciprocal bond or connexion, nor any common channel of communication between them; neither any internal pith or medullary substance pervading the polyparium." (p. 1.) But subsequently he arrives at the sounder conclusion that, though no connexion or communication between the cells of the *Flustra* can be discovered, "there is a strong presumption of some imperceptible channel or medium traversing the leaf, whereby portions with new hydræ are generated from the older parts." (p. 13.) The polypidom holding in its entirety myriads of individuals begins always with one only cell; and this, to secure a broader foundation for the future colony, is always horizontal, while those which pullulate from it are, and must necessarily be, vertical. The original dies and consolidates, and so do its immediate successors, after producing others above them, which are ejected from their living progenitors in regulated ordination,

each after its kind. We have the early stages of one or two species distinctly traced; and there is a very good account of their ciliated ova.

The chapter is illustrated with eight plates, representing *Flustra carbasea*, *foliacea* and *truncata*. The *Fl. papyracea* represented in plate 7 is very unlike any specimen of the species we have seen, and we are inclined to think it no other than a variety of *Fl. foliacea*. Plate 8 represents not solely *Flustra Murrayana*, but, as we would conjecture, three species; viz. fig. 1. *Cellularia avicularia*; fig. 2. probably *Flustra Murrayana*; and fig. 6. certainly *Flustra avicularis*.

Chapter 2 treats of "Investing Ascidian Zoophytes," and has three illustrative plates. The first of them (pl. 9) represents *Flustra hispida* remarkably well; and the species is well described in the letter-press. The polype has about thirty-five tentacula. "None of the marine ascidian hydræ have shown me a complement alike numerous. This animal is likewise among the larger species, being about a line and a half in height, and the tentacula composing its cell expanding nearly as much. Its form is elegant, light and beautiful. It rises very leisurely and gradually from the cell; but its retreat is most precipitate, vanishing in a moment." (p. 30.) The ovum has the same origin and properties as that of *Flustræ* generally, but it is quite different in shape from any of them: it is "pure white, elliptical, thin, and fringed by a border of active cilia,—all which renders it a beautiful object under the microscope." This peculiar figure of the ovum, taken in conjunction with the peculiar substance of the polypidom, would vindicate the claim of the production to be the type of a new genus.

Alcyonidium parasiticum (pl. 10) is equally well figured and described. Plate 11 illustrates a new species named *Alcyonidium mytili*, from its infesting chiefly the shells of the mussel. The species would have been better placed apparently in the genus *Flustra*. "It appears as a small spot, or spreads over a superficial area of various extent, until equalling 2 or 3 inches, according to the specimen. The diffusing edge is always curvilinear, the patch of dingy white, and seldom thicker than writing-paper." "The upper surface is soft, wholly composed of numerous cells, apparently with an elliptical orifice; and the lower or deeper part polyangular. However, the exact form of the adult is not to be easily discovered; and, in general, the real figure of the cell seemed to me to be hexagonal." (p. 36.) We suspect this is the same thing as the *Flustra Peachii* of Couch.

The "*Alcyonium*" is the subject of Chapter 3. Plates 12, 13, 14 and 16 illustrate the multiform character of *A. gelatinosum*; plate 15 is a characteristic figure of *A. hirsutum*, here named *A. palmatum*; and the various figures in plate 17 are referable to the same species.

Chapter 4 is entitled "Miscellaneous Zoophytes." The first of them described is *Hydra (Coryna) squamata*, pl. 18. figs. 1-10; but the species is misnamed, for it is really the *Hydractinia echinata*. It is well described, excepting in so far that the author seems to mistake its muricated basis for the epidermis of the shell on which the zoophyte has grown. The efforts of Sir John to breed the animal were

only partially successful, but it appears that the ova, after their discharge from the external and naked bulbules, do not enter into medusiform larvæ, but develop at once into the hydraform condition of the parent.

The figs. 1-6 of plate 19 represent *Sertularia thuia*. The 20th plate is dedicated to the *Pedicellina*, but the figures tell less of its structure than do those of Hassall and Van Beneden. We may quote the general description of the species (*P. nutans* = *P. gracilis*, Sars), which is also applicable to *P. echinata*, not distinguished from the preceding by our author. "In an early stage it appears as a white globular head, crowning a short stem, one scarcely half a line high. When more advanced, it generally occurs, or, perhaps, more readily attracts notice, when in numerous colonies of individuals rising about a line and a half. Then it consists of a smooth white stem, crowned by a variable campanulate hydra, with fourteen ciliated tentacula. The stem of certain specimens has appeared prickly, sometimes invested by foreign matter; and I have thought a web uniting the roots of the tentacula discernible.

"At this stage the *Pedicellina* generally dwells in numerous societies, implanted on the twigs of other zoophytes, or distributed profusely over shells.

"The adult rises half an inch in height by a smooth bare stem, with twenty or a greater number of hydræ, meagrely and irregularly disposed on branches or pedicles to right and left, on one or on both sides. But such luxuriance is very rare. Among a multitude of specimens I have seldom found any with even a few animals.

"It is only in early stages, when the hydra is solitary, that it can be most satisfactorily inspected. Then, the head is discovered to be of an extremely variable shape, frequently distorted in an uncommon manner,—such as I have not seen in any other zoophyte,—and next restored to its symmetry. Sometimes it is flattened, or it is preternaturally enlarged on one side, swollen, contracted, or otherwise, at the will of the animal; and always presenting considerable diversity of aspect, either by one or by the various specimens of a colony." (p. 60.) The author notices a singular habit in the species. He says, "Though quiescence always prevails during the earlier part of the day, among a colony of single animals, that is, those consisting of only a head and stem, all are observed in motion as the hours advance, and as the sun begins to decline. The tentacula closing over the mouth, the heads become globular, nod, and strike against each other, which they are enabled to do by flexibility of the stalk. Where many are arranged in a row, they seem literally to pass a blow along the whole line, as if in sport. Singular it is, that all animals, even the humblest, seem to have moments happier than others of their existence; and testify, by unequivocal demonstration, their present enjoyments in conscious security." (p. 62.)

Sir John goes on to describe *Tubularia sultana* = *Fredericella sultana*, and *Avenella fusca*, a hitherto unnoticed ascidian zoophyte parasitical on other zoophytes, &c. These species are figured in the first volume. Another new ascidian zoophyte he names *TRITICELLA flava*,

pl. 19. fig. 7, which differs from all others of its family in every individual being distinct of itself. It is the cell of a *Vesicularia* without the composite character produced by a connecting stem or tube; and the single ovate cell is simply supported on a short pedicle about half its length. The polype has the usual structure of the ascidians, and is furnished with twenty tentacula. The specimens were found on the envelope of an ascidia.

Crisia eburnea occupies rather uselessly a large portion of plate 19; and two plates are devoted to *Coryna glandulosa*, the plate 22 representing a specimen with a very peculiar aspect, in which it is difficult to trace the characters of the species.

"Calcareous Zoophytes" are embraced in Chapter 5. The species noticed with more or less detail are *Flustra membranacea*, *Lepralia pustulosa*, *edentata*, *punctata*, *nitida*, *lineata*, *margarita*, *spinosa*, *trispinosa* and *squama*, *Cellepora cingens*, *pumicosa*, *ramulosa* and *iris*, *Membranipora pilosa* and *Tubipora serpens*. Several of these names are new to the British zoologist, but whether they designate new species is somewhat uncertain, for Sir John Dalyell never uses a specific character, which, in our opinion, every new species ought to have, and that neatly and curtly defined so as only to embrace its own peculiarities. The lengthy characters now so much in use are comparatively useless, and bespeak feebleness in the authors of them. *Lepralia pustulosa* seems new, and is characterized by a circle of minute tubercles around the base of each cell which is raised with a plain circular aperture; of *L. edentata* we can say nothing; Sir John's *L. punctata* is the *L. variolosa*, Johnst., nor are we satisfied that his *L. lineata* is distinct from it. *Lep. margarita* embraces more than one species, one of them being apparently *L. ciliata*, or perhaps the ovarian capsules only of a species whose cells have been obliterated. *Lep. spinosa* is *Lep. immersa*, Johnst.; but neither the description nor figure enables us to characterize the *Lep. squama*. *Cellepora cingens* is new to us; but the *C. iris* seems to be nothing but a small specimen of *C. Skenei*, Flem.

Chapter 6 is the most interesting in the volume. It embraces the "Lunate ascidian zoophytes—*Cristatella*, *Alcyonella*, *Plumatella*," which are beautifully illustrated and admirably described. The figures of the *Cristatella* have really surprised us, and exhibit an animal curious beyond imaginative creations. We shall seek for it carefully to satisfy the curiosity which Sir John has raised by his pen and pencil. "Among the zoophytes of the fresh waters of Scotland," says our author, "this is perhaps the most remarkable of all. The features by which it is distinguished belong to none of the rest, nor, it may be, to any other known animal of the universe." (p. 89.) The history of it is very complete, but it must be read as a whole to be properly appreciated.

Equally complete and interesting is the history of the *Alcyonella*, but we are not aware that any of the facts are unknown to naturalists. Two plates are appropriated to its illustration; and Sir John attempts to define two species of the genus—the *A. stagnorum* and *A. gelatinosa*, and a nameless third one is indicated. The author

admits that further observations are required to prove their distinctness. The characters of the two named may be thus expressed:—

Al. stagnorum, mass gray, polypes with 42–44 tentacula.

Al. gelatinosa, mass yellowish or gray, polypes with 70 tentacula.

Of the *Plumatella* we may confidently assert, that the history and figures given by our author are very superior to any hitherto published. His observations go to prove the distinctness of *Plumatella* as a genus, but he has seen only one species, the variations of which are not so prominent as to constitute them different in kind: “the reciprocal resemblance of specimens to each other is not so striking as at once to prove identity, though enough to establish kindred.” (p. 124.) The tentacula vary apparently from about fifty to seventy, and Sir John says that the number certainly augments with age.

Chapter 7 is devoted to “*Ascidia*.” We must content ourselves with a mere indication of the species described. 1. *Ascidia villosa* = *Pelonaia corrugata*, Forb. 2. *As. intestinalis*, a species not described by Forbes and Hanley. 3. *As. rustica* = *As. scabra*, Forb. and Hanl. The “young brood” of this represented on plate 35 is surely a distinct species. 4. *As. scabra* = *As. virginea*, Forb. and Hanl. 5. *As. mentula*, a rare and gigantic species. “Specimens obtained in the Orkney Islands are no less than 8 inches in height, and 3 in their widest diameter.” 6. *As. papilla* = *Cynthia grossularia*, Van Beneden. This is fully described, and its mode of propagation ascertained.

“The Compound *Ascidia*” are described in Chapter 8, and five plates are devoted to their illustration. We cannot undertake to collate the species with those described by other authors, for the subject is difficult, and specific characters of ready apprehension have not been given anywhere. Sir John denominates one kind described by him *Botryllus verrucosus*; but he has left the others figured to be named by those who list.

Chapter 9 contains good figures of some “asteroidal zoophytes,” viz. *Lobularia digitata*, *Virgularia mirabilis* and *Pennatula phosphorea*. We need scarcely add that the history of each of them is given in full and interesting detail.

The “*Actinia*” or “the Animal Flower” is the subject of Chapter 10, and the portraits of the species are exhibited in five plates. After an excellent history of the genus, the author proceeds to describe the species whose habits he has studied with so much patience and care. 1. *Actinia mesembryanthemum*. 2. *Ac. cerasum* = *Ac. chio-cocca*, Johnst. 3. *Ac. gemmacea* = *Ac. coriacea*. 4. *Ac. elegans*, probably a new species. 5. *Ac. explorator* = *Ac. troglodytes*, Johnst. 6. *Ac. lacerata* = *Ac. anguicomma*, Price. 7. *Ac. maculata* = *Adamsia palliata*. 8. *Ac. dianthus*.

Chapter 11 is entitled “Miscellaneous Supplementary Observations.” It contains some additional remarks on the *Hydra tuba*, the story of whose singular metamorphosis formed such a charming episode in the first volume; and we have also another plate devoted to its further illustration. It may be remembered that the *Hydra tuba*, at uncertain epochs of its life, produced in succession, as from

a roll, minute medusiform young, which have been presumed to be the young of some larger and common species; but our author has never in one instance seen them undergo "the smallest sensible change," "either by organic increment, or the evolution of additional parts. They perished in the precise state wherein they were first recognized," although some specimens survived for sixty days. Sir John adds: "I have not heard that any other naturalist has been more fortunate,—that he has succeeded in preserving those component portions of the medusan roll under uninterrupted observation until some farther evolution, alteration, and increment, admitted their identification with adult animals. If this has actually been done, my ignorance of it must plead an apology for protracting the narrative. I have observed it affirmed, it is true, that older and larger Medusæ are the adults of the younger and smaller tribe now referred to. But I have not seen any demonstration of the facts, possibly owing to my very limited sphere of information." (p. 242.) In fact the additional observations of Sir John Dalyell make us doubt whether they can ever pass into larger Medusæ, any more than the medusiform larvæ of the *Campanularia* can do, but rather that it may be they should develope into the hydra-like parent, which produces these Medusæ only at uncertain intervals and under unascertained conditions.

Plate 51 contains good figures of *Medusa aurita* and *capillata*. Other species named *Medusa crinita*, *proboscidea*, a species of *Tima*, *Medusa fimbriata*, *Beroë ovata*, *B. punctata*, *B. bilobata*, *B. pileus*, are represented more or less fully in the plates which follow.

Plate 55 is named *Valkeria spinosa*, but it has a very peculiar aspect which puzzles us. Plate 56 is entitled "Ascidia," and we presume the species to be *A. mentula* described in a former portion of the volume; which concludes with an interesting chapter on the "Nature of Zoophytes."

First Steps to Zoology. By ROBERT PATTERSON. Simms and M'Intyre. London, 1849.

This recent addition to our stock of popular books on natural history is an abridgement of Mr. Patterson's more extended work, the 'Zoology for Schools.' Here his object has been merely to furnish the young reader with short notices of the various orders into which naturalists have divided the animal world, and in this he has fully succeeded. No more prominence is given to one portion over the others than from the nature of the subject is almost inevitable, and we think that the 'First Steps to Zoology' will be found to convey to the beginner a very fair impression of the extent of the animal kingdom, and of its great leading divisions.

The book is illustrated with a large number of woodcuts, but either from long wear or from carelessness in working, the present impressions are very inferior. This is a pity, as in all probability a little care would have prevented such an occurrence; and in the event of a second edition appearing, we hope Mr. Patterson will try whether something cannot be done to improve his book in this respect.

The Elements of Botany. By A. DE JUSSIEU. Translated by
J. H. WILSON, F.L.S. &c. Van Voorst.

The "*Cours élémentaire*" is so well known that it is unnecessary for us now to speak of the great merits it possesses; we have here merely to express an opinion on the manner in which Mr. Wilson has executed the task of translating into English. Some few points might be adverted to where there is room for improvement, but on the whole the translation is very well done, and exhibits more than the average amount of care and fidelity. With the help of the original woodcuts and the adoption of a similar page and type, the English version, which perhaps retains rather too much of the French idiom, has been made quite a reproduction of the original, and as such will prove of great utility to those who cannot use the French version with facility.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

May 23, 1848.—R. C. Griffith, Esq., in the Chair.

OBSERVATIONS RELATING TO SOME OF THE FORAMINA AT THE BASE OF THE SKULL IN MAMMALIA, AND ON THE CLASSIFICATION OF THE ORDER CARNIVORA. BY H. N. TURNER, JUN.

Of all those parts of an animal frame to which the zoologist may direct his search for characters truly indicative of the affinities of the species, or of the group to which it obviously belongs, there is perhaps none in which a greater number of such characters are presented at one view than in the lower surface of the skull. Here are seen,—not only the teeth, whose differences of structure always have, and always will be, made considerable use of in assigning characters to zoological divisions, in whatever way our opinions as to the value of the characters derived from these organs may be modified by further researches,—but also the form and development of the zygomatic arch, with the capacity of the temporal fossa, and the mode in which the jaw is articulated; the form and extent of the bony palate, with its pterygoid appendages, the situation of the occipital foramen, and the structure of the condyles to which the atlas articulates, and many other characters of greater or less apparent consequence, may in the under surface of the cranium be all distinguished at a glance.

Accordingly we find that such of our more modern naturalists whose endeavour has been to fix classification upon a truly philosophic basis, instead of resting satisfied with the arbitrary subdivisions formerly in use, have directed their observations particularly to this part, so that the more obvious characters which it affords have been well observed, and turned to very useful account in determining the extent and affinities of groups; but in some cases, where, from the very close alliance existing between the genera, the differences presented in this part are necessarily very minute, their importance in a zoological point of view has not as yet been recognized. As some of the characters of which I propose to avail myself in the

classification of the order Carnivora consist of peculiarities in respect to certain of the foramina at the base of the cranium, I may perhaps be permitted, although the foramina have already been to some extent studied by those who have entered minutely into the details of mammalian osteology, to point out some instances in other orders, where, in the course of such observations as my opportunities have permitted, I have noticed relationships between the peculiarities presented by the foramina and certain natural groups already established by well-marked characters.

For example, when we see that throughout the whole series of Marsupial Mammalia—an order which, notwithstanding the widely different modifications which its forms present, is marked by many striking peculiarities of structure which quite isolate it from all other members of the class—a number of minor peculiarities are equally constant, and therefore in any species equally indicative of that particular type of structure; and among these, that the internal carotid artery does not enter the cranial cavity, as in most mammalia, by a foramen in the tympanic bone, nor—as is the case in many, and might here be well expected, from the small development of the tympanic bone—through a fissure between that bone and the basi-sphenoid, but through a special foramen, which is pierced on the side of the basi-sphenoid bone, and enters the skull in an inward and forward direction,—we are surely justified in attaching some importance to this peculiarity in a zoological point of view, and in considering it just as characteristic of the Marsupial order as the articulation of the head to the atlas by a double condyle is of the Mammalian class itself.

The remarkable differences in general structure presented by the skull throughout the Rodent order, so carefully investigated and judiciously applied to its classification in the researches of my accomplished friend Mr. Waterhouse, render it quite unnecessary to descend to such minute and comparatively unimportant characters as those which the foramina may afford; and from the frequent imperfection of bony development in these usually small and rather lowly organized mammalia, we cannot expect to find the characters presented by the foramina of so strictly definite a nature as those I shall have to point out in animals of higher types of structure; but nevertheless, when due allowance is made for these occasional imperfections of development, we shall yet find, that although the characters of the foramina in this order are not sufficiently decided to be very serviceable to the zoologist, they present a certain general accordance throughout the groups, which in connection with the present subject may perhaps give them some degree of interest.

In this order, the canal, for which I here propose the name of alisphenoid canal, and which serves to protect the continuation of the external carotid artery during a part of its course, seems to be of nearly constant existence, although in many species of the *Hystrioidæ* it coalesces, through non-development of the separating lamina, with the fissure passing through between the walls of the pterygoid fossa into the orbit. The fissure alluded to, for which Mr. Waterhouse

suggested, though I am not aware that he has published, the name of interpterygoid canal, is a characteristic of this family. There is another remarkable canal which exists in I think I may say the greater number of the species in this order, and which I have not as yet noticed in any species of other orders: its posterior opening is near the foramen ovale, sometimes on the outside and sometimes on the inside of the cranium; it extends forwards a short and variable distance, then opens externally, and serves to transmit a nerve to the masticatory muscles: this canal, which is not unfrequently double, I will here, for convenience of reference, designate the external ali-sphenoid canal*.

The Hares present characters differing from the rest of the order, in the absence of the ali-sphenoid canal†, and in having a distinct canalis caroticus excavated in the tympanic bone; the external ali-sphenoid canal usually exists, and is double, but from imperfection of bony development is not always very clearly demonstrable.

The ali-sphenoid canal must be said to be of constant existence in the *Hystricidæ* (as defined by Mr. Waterhouse), although, as I before observed, it often coalesces with the interpterygoid, through non-ossification of the lamina which separates them; for its outer wall is always distinct; and even in the Caviine subfamily, where the maxillary bone extends back to meet the temporal, the ali-sphenoid bone always lines the bridge thus formed, so that the canal no less deserves the name which I have ventured to propose for it. The external ali-sphenoid canal also exists in this family; it is not usually demonstrable in the *Caviina*, having apparently coalesced with the true ali-sphenoid; but in a large skull of the *Capybara* contained in the Society's collection it is very distinctly separated. In some of the Hystricine subfamily (*Sphiggurus*, *Erethizon*, *Chetomys*) this canal is double, and in such of them as have the true ali-sphenoid canal coalesced with the interpterygoid, the lower division of the external ali-sphenoid might perhaps be mistaken for it; but the true ali-sphenoid canal always opens anteriorly *within* the lamina which forms the external pterygoid process and the outer boundary of the coalesced foramina sphenoid-orbitarium and rotundum, while both divisions of the *external* ali-sphenoid canal open on the outside of this lamina; in those species however which have the true ali-sphenoid canal separate, the homology is at once apparent.

Although the arrangement of foramina in the common Rat and

* This canal is alluded to by Cuvier (*Anatomie Comparée*, 2nd edition) in several cases; I will cite one of them:—"Dans le porc-épic commun . . . il y a dans l'aile pterygoïde externe deux canaux, l'un inférieure, s'ouvrant en arrière à la racine de cette aile, un autre supérieure, et s'ouvrant près du temporal. C'est le premier qui paraît être l'analogue du canal vidien." That is, of the canalis ali-sphenoides, as I shall hereafter show that it is not the homologue of the vidian canal; the second alluded to by Cuvier is the canalis ali-sphenoides externus.

† Cuvier also observes, "Dans les lièvres . . . le canal vidien (the ali-sphenoid) n'est qu'un trou dans l'aile pterygoïde externe," and his editors add, within brackets, "et que l'on distingue dans l'orbite tout près et en dehors du précédent." The hole alluded to, however, from being situated quite in the depth of the pterygoid fossa, is much more like the interpterygoid canal in the *Hystricidæ*.

the common Squirrel appear very different from each other, there is in fact but little to distinguish, so far as these peculiarities are concerned, between the families to which they respectively belong. In the latter animal, and indeed throughout the family, we find the following arrangement: the foramen ovale is a large round hole, within the edge of which open the posterior orifices both of the true ali-sphenoid canal and the canalis ali-sphenoideus externus, and also of a canal which only penetrates the substance of the basi-sphenoid bone, and meets its fellow from the opposite side. The foramina lacerum anterius and posterius are each of small size; I cannot perceive any distinct canalis caroticus. In the Rat the canalis ali-sphenoideus externus does not exist, its place being marked by a rather indistinct groove in the bone; the true ali-sphenoid canal is present, and its posterior opening is some distance anterior to the foramen ovale; the foramen entering the substance of the basi-sphenoid also exists, but is situated some distance behind the foramen ovale; from the posterior corner of the external pterygoid process there is continued a little bridge of bone, which arches completely over the foramen ovale: there is no canalis caroticus, a groove only representing it. But in specimens that I have dissected for the purpose, I have noticed that the *external* carotid artery actually enters the cranium through a canal in the posterior part of the tympanic bone, from which it emerges above, and after passing within the cranium for a short distance, passes out again through the long fissure that separates the anterior side of the tympanic bone both from the ali-sphenoid and the squamous bones; it then passes through the little bridge that crosses the foramen ovale, and then through the ali-sphenoid canal, after which it, as usual, meets with the second branch of the fifth pair of nerves, and accompanies it through the infra-orbital foramen to the upper lip. But the chief differences here pointed out between the Rat and the Squirrel seem only to consist in the extension backwards, in the latter, of the ali-sphenoid canal to the foramen ovale, and the presence or absence of the lamina that encloses the canalis ali-sphenoideus externus. Some genera of Rats (as *Cricetus*, *Cricetomys*, *Hapalotis*, *Hydromys* and others) present in these respects the same characters as the Squirrels, in some of the larger species of which we even see a very slender arch of bone just before the foramen ovale. However, in all those genera of Rats alluded to, the fissure by which the external carotid artery emerges from the cranium is very apparent, and I have not perceived it to exist in any of the *Sciuride*.

In the Edentate order, which, though so limited in the number of species, is far from being so in the variety of its forms, the foramina present characters which will connect together those forms which other and more important characters show to be nearly allied. In the Armadillos the optic foramen is small and distinct; the foramen rotundum has coalesced with the foramen spheno-orbitarium; the foramen ovale is a distinct, roundish aperture: there is usually a distinct canalis caroticus, but in the *Dasypus sexcinctus* it is only enclosed at the anterior part; and in one specimen that I have seen,

that of one side only is completely enclosed: the foramen lacerum posterius is very small; there is a distinct foramen glenoideum. In the *Manis* the characters of the foramina are very similar, but there is no canalis caroticus.

In the *Orycteropus Capensis* the small optic foramen is placed back within the lamina enclosing the coalesced foramina speno-orbitarium and rotundum, so that in a side-view it is concealed: just before the foramen ovale is an opening into the substance of the bone: the foramen lacerum anterius extends all along the anterior and inner side of the bone of the ear; the foramen lacerum posterius is of a roundish oval form; the foramen condyloideum is very large: there is neither a distinct canalis caroticus nor a foramen glenoideum.

The Sloths have some peculiar characters of their own: in them the foramina opticum and speno-orbitarium are distinct within, but the orbito-sphenoid sends out a little process forming a canal, which serves as the external opening for both of them; the foramen rotundum is quite separate, opening at some distance below: in the *Bradypus tridactylus* it opens just at the point where the vertical lamina of the palatine bone joins the orbito-sphenoid; the foramen ovale is also very close to the junction with the pterygoid. There is a distinct canalis caroticus, but no foramen glenoideum; the foramen condyloideum is large and conspicuous.

It is in the Pachydermatous and Ruminant orders, however, that I am enabled to show the clearest indications of accordance between certain characters of the foramina and the groups into which these orders are divided. In the elaborate and highly-interesting paper read not long since by Professor Owen before the Geological Society, in which he suggested the admirably-chosen names 'Artiodactyla' and 'Perissodactyla' for the two subdivisions of the Ungulate Mammalia, it is much to be regretted that he has in no way alluded to the characters which the under surface of the skull presents; for they show three different types of structure, which, so far as those genera, of which the under surface of the skull is known, would indicate, appear very distinctly separable. Of these, two are included in the order Pachydermata, as usually adopted, while the third is that of the Ruminant. I am not at present prepared to offer any decided opinion as to the suggestion of Professor Owen, that the two orders ought to be united; and indeed that question forms no part of the present disquisition; but in pointing out the characters presented by the cranium in these three distinct types, I cannot but very much regret that I have not been able to meet with skulls of any of the fossil genera that afford the intermediate links by which Professor Owen proposes to unite the orders, in such a condition as to enable me to discriminate the characters of the basal portion of the cranium. Perhaps the absence of such specimens may in some measure account for the omission of any notice of these characters in the paper to which I have alluded.

In looking on the under surface of a Ruminant skull, the observer is at once struck with the great separation between the nidus of the last molar tooth and the walls of the canal of the posterior nares;

while in both the divisions of the Pachydermatous order the connection between the palatine and maxillary bones is continued quite to the posterior termination of the latter. In the Ruminant the canal of the posterior nares is of immense depth in the vertical direction, its walls extremely thin, the true pterygoid bones reduced to thin laminæ lining the posterior part of the canal, and forming the hamular processes; and although in the Camel and Llama, the external and internal processes (of which the former belongs to the sphenoid, while the latter is the true pterygoid bone) being each well-developed at the tip, there is a considerable notch between them, the outer pterygoid entirely wants that lateral expansion which in animals having a pterygoid fossa forms its outer wall.

The occipital bone has usually its basal surface flat, marked with eminences, of which different ones are more or less developed in different genera. In the Sheep there is a salient one on each side, rendering the surface of the bone between them quite concave; while in the Camel, the Ox, and the Deer, it is another pair of tubercles that are most developed, being situated close to the condyles, the articulating surfaces of which approach each other more than in the Hogs*, and in the Deer and Camel are even continued on to the tubercles. The paroccipital processes also in Ruminants take their origin more towards the outside than in the Hogs, and the space between this process and the condyle is much more deeply excavated. Each of the three separate types of Ungulata before-mentioned has likewise its distinct form of articulation for the under jaw. That of the Ruminants is a slight convexity, shelving off into a nearly semi-circular concavity behind, thus admirably adapted for the rotatory grinding motion of the under jaw; this concavity is bounded behind by a ridge, which terminates within in a small process†.

The following characters are afforded by the foramina:—The foramen ovale is large, distinct and exposed, completely enclosed by the ali-sphenoid bone; there is no trace of an ali-sphenoid canal, nor of a distinct canalis caroticus, it being represented merely by a notch in the auditory bulla, having merged into the adjacent fissures. The foramen condyloideum occupies a rather concealed situation, especially in the Deer, where it is quite hidden by the laterally expanding anterior termination of the occipital condyle: the foramen glenoidium (so named in the second edition of the '*Leçons d'Anatomie Comparée*') exists in Ruminants.

The Hogs and allied genera, constituting the artiodactyle division of the Pachydermata, are constructed upon a second type, also marked by characters seen in the under surface of the skull. The palate is flat and solid, its level much below that of the base of the cranium, extending back quite as far as the extent of the molar series, which throughout its length is closely applied to the walls of the posterior nares; therefore the large notch so remarkable in the Ruminant does

* In the Camel they are absolutely in contact below.

† This process, which is placed more outwardly in the equine type of Pachydermata, is in the Rhinoceros much elongated, and even touches the paroccipital, enclosing the meatus auditorius between them.

not exist, and the pterygoid fossa is nearly in a line with the molar series. The occipital bone presents characters strikingly different from that of the Ruminant; its surface is flat beneath, with a ridge along the middle; the condyles are rather distant from each other, their articulating surfaces terminating very abruptly in front; the paroccipital processes are straight, much prolonged in the genera *Sus* and *Babirussa*, placed less laterally than in either the Ruminants or the other division of the Pachydermata, and from each is continued inwards a ridge on about the same level with the base of the occipital bone, and on or near its summit the foramen condyloideum is seen. The space is short between the posterior nares and the auditory bullæ, and the origin of the zygomatic process, with its articulating surface, is so much pushed back, that a line drawn across from one to the other would pass right through the bases of the large udder-shaped processes of the tympanic bone; and the pterygoid processes of the sphenoid have so much lateral expansion, that when the true pterygoid bones have sufficient development to form the inner walls, the fossæ are very distinctly marked. For the articulation of the lower jaw there is a transversely elongated surface, concave transversely, slightly convex in the antero-posterior direction, which serves alone as a fulcrum for the movements of the jaw, since the space behind it is rugged and does not present the characters of an articulating surface.

But the group at present under consideration seems clearly to admit of separation into two distinct subdivisions, to the first of which, including the genera *Sus*, *Babirussa* and *Phascolæus*, the foregoing observations are intended more particularly to apply. Of the second, the Peccary and the Hippopotamus present us living examples, and to it the greater number of the extinct genera of artiodactyle Pachydermata must belong, if the difference which the two subdivisions present in the structure of the molar teeth be found constantly to accompany those of the skull*.

As so few genera of this second subdivision of the artiodactyle Pachydermata have presented their entire cranium for our examination, it will be better to content ourselves with pointing out the characters in which that of the Peccary, a convenient standard for comparison, differs from the genuine Hogs.

In this animal the pterygoid bones and processes are pushed nearer the middle, narrowing the aperture of the posterior nares; and although the adult Peccary shows no fissure between the alveoli of the

* In the very brief notice communicated to the Society last year by Mr. Hodgson, of a diminutive species of Indian Hog, on which he founds the genus "*Porcula*," it is much to be regretted, that while endeavouring to establish the zoological position of the genus between the Hogs and the Peccary, and mentioning, as approximating it to the latter, some very trivial external characters, together with the number of molars, which being six in each series, cannot indicate such an affinity, since the *Babirussa*, a true Hog, has (in the adult state at least) only five, he has omitted to acquaint us with the structure of those molars, which it might have been expected that a naturalist would have made the subject of particular observation, and which would very probably have decided the point of affinity in question.

molar series and the walls of the nasal cavity, yet in a rather young skull of *Dicotyles labiatus*, where the penultimate molar has not quite risen into its place, and the last remains still imbedded in its socket, there is on each side a narrow fissure between the posteriorly projecting nidus and the pterygoid appendages; but this character can scarcely be reckoned among some others which do seem to approximate the Peccary to the Ruminants, since the fissure is great even in the adult Ruminant, and in no adult member of the Pachydermatous order does the termination of the molar series extend back so far as to reach the anterior termination of the pterygoid appendage.

It is in the occipital bone that the Peccary departs most from the character usual in the Hog-tribe, and approaches to that structure which is presented by the Ruminants, and by the other large group of Pachydermata. The origin of the paroccipital processes and the absence of the ridges extending inwards from their bases, together with the position of the foramen condyloideum, approximate the genus to the last-mentioned groups; but the processes themselves, although they are short, approach nearer in form to those of the Hogs. The lateral expansion of the pterygoid processes, although still considerable in *Dicotyles labiatus*, is much reduced in the Tajaçu. The glenoid cavity is not pushed back to the same extent as in the Hogs, and its level is relatively much lower than either in them or in the Ruminants; so that a line drawn through the posterior terminations of the articulating surfaces would pass through the auditory bullæ near their lower surfaces; and the structure of the glenoid cavity itself is quite distinct, somewhat resembling that so characteristic of the order Carnivora. It is an oblong surface, lengthened in a direction slanting from behind forwards and outwards, and is concave in the antero-posterior direction. The Hippopotamus shows itself to be closely allied in the structure of the occipital bone and of the glenoid cavity: the pterygoid bone is not sufficiently developed to form the inner wall of a fossa*.

In both divisions of the artiodactyle Pachydermata the foramen ovale is not completed by the ali-sphenoid behind, but truly merits the name of a "foramen lacerum": there is no trace whatever of the ali-sphenoid canal, nor of the canalis caroticus, nor, in the true Hogs, of the foramen glenoideum; this however exists, but is very small in the Peccary, in which also the position of the foramen condyloideum differs from that of the true Hogs in a degree corresponding to the altered structure of the occipital bone.

The third great type of Ungulated Mammalia (the *Perissodactyla* of Professor Owen) is also marked as distinctly by the conformation of the base of the skull, as by that characteristic structure of the tarsus which enables the palæontologist, on looking only at an astragalus, to recognize "the armed Rhinoceros" as readily as if the animal complete were presented to his view. The skulls of the Horse, the Tapir, and the Rhinoceros, when we look on their under surfaces,

* In an excellent skull of this animal contained in the Society's collection, the lacrymal bone forms within the orbit a considerable osseous bulla, having thin parietes, and apparently destined for the protection of the lacrymal sac.

show at one glance so striking a similarity of plan, that if we can but divest ourselves of prejudged notions, which the great contrast in external form may have imparted, we cannot doubt their close alliance; and the little Hyrax, the only other living genus of this family, when we make allowance for those differences of proportion invariably existing between species organized upon one plan, and differing much in size, will also be found closely to resemble its more gigantic relatives. In this group the bony palate is curtailed in length, its level not much below that of the base of the cranium, and the size of the posterior nasal orifice made up chiefly by its great increase of length in the antero-posterior direction. Here also there is no fissure between the wide-spreading walls of the nasal canal and the nidus of the last molar tooth. The form of the auditory bulla presents a nearer approach to the Ruminant than the Hog, as also does the occipital bone, especially in the form and relative position of its condyles and paroccipital processes; but the under surface of its basal portion is flat, and very convex in the transverse section; the lower jaw articulates on a fulcrum similar to that described in the true Hogs, but posteriorly is a smooth concave surface, which terminates behind in a characteristic salient process. Among the characters of the foramina this division is well-distinguished from either of the others by the presence of the ali-sphenoid canal, which exists in all the living genera, and, as already pointed out, is wanting both in the Ruminants and in the Hog-tribe*.

This canal is also present in the Elephant and Mastodon, an aberrant division of the order, also possessing toes in uneven number, and still further characterized by being the only members of the Ungulate division that have a distinct *canalis caroticus*, and by their wanting the *foramen condyloideum*.

A sufficient number of examples have now I think been adduced, to show, that although the instances may be few in which a group could be isolated by characters drawn from the foramina alone, yet in most cases they will be found to be of some assistance in marking the limits of closely-allied divisions; and even in those cases which I have brought forward, it is far from my intention to advocate that

* Since this paper was communicated to the Society, it has struck me that the similarity of structure (which must have been observed by every naturalist who has given attention to the subject of dentition) existing between the premolars and true molars in the members of the Perissodactyle division, may prove an important addition to the zoological characters of that group. This must of course depend upon the confirmation, by further researches, of the idea, that in most Mammalia a *premolar* represents, in the homologies of its component parts, only the *half* of a *true molar*; but there can be no doubt that in the group alluded to the premolars each represent the *whole* of a true molar, for the resemblance in most cases is very striking. Among all the genera, the extinct *Lophiodon* is that which looks most like an exception: unfortunately, I have never had access to any specimens of this genus; but so far as I can judge of it by the figures published, I should be inclined to the belief that further researches will show, that notwithstanding the apparent dissimilarity, the premolars of the *Lophiodon*, as well as those of the other members of the group, each represent the whole of a true molar; and that in the other divisions of the Ungulata, as well as in most members of the class, the half only of a true molar is typified.

any use need be made of such characters as these, when the groups can be so well established upon characters more obvious and important in their nature.

We frequently find groups which, though very extended as to the number of species they contain, are much more limited in respect to the varieties of structure they present than other groups apparently of equal rank containing a much smaller number of species. Such groups are of course always the most easy to isolate, but the most difficult to subdivide: it is in these that we find the most confusion existing, and the greatest variety of opinion among naturalists as to the manner in which their subdivision should be effected. Excepting in the highest divisions, it is but of late years that naturalists have at all appreciated the distinction between what are usually termed "essential" and "adaptive" characters, of the former of which, as we descend to the lower groups, not only is the existence, but also the importance, much less easily recognized.

The base of the cranium, as I before observed, is, from its having less connexion than most parts of the bony framework with the peculiar wants of the species, by far the most rich in such characters; among those which the foramina may afford, I must here dwell rather particularly on the evidences of affinity afforded by the presence or absence of the ali-sphenoid canal, and also explain my reasons for assigning it a new name. As will appear from the observations I have brought forward, it exists throughout the Rodentia, excepting the aberrant family of Hares; it is wanting in the Marsupials and Edentata; and among the Ungulate division, including the Ruminants and Pachydermata, the Artiodactyle division, including the Ruminants and those Pachyderms which have the toes in even number, is constantly characterized by its absence; while in the Perissodactyla it is as constantly present. In the first edition of the '*Leçons d'Anatomie Comparée*,' the illustrious author only alludes to this canal in a very vague manner; and in the more recently published edition, in which the osteology of the cranium is much more fully elaborated, it is spoken of everywhere as being the vidian canal,—the existence of a vidian canal being denied in those animals which do not happen to possess it. From the time when I commenced the series of observations of which the present is an attempt to sum up the results, I always felt inclined to the belief that the canal in question did not correspond in situation to the vidian canal as known in Human Anatomy, since this canal commences just at the root of the internal pterygoid process, while that pointed out as such in the work alluded to is quite on the outside of the homologue of the outer one. Among the rest, the Monkeys are spoken of as wanting the vidian canal; but on removing from the skull of a small monkey in my collection the whole of the posterior portion, and the temporal bones with auditory bullæ, the posterior apertures of the vidian canals became very apparent, and fine bristles passed readily through them into the orbits; and in other skulls belonging to the Quadrumanous order, provided that those portions of the upper maxillary bone which originally constitute the alveoli of the hinder molars do not rise high enough to

conceal the vidian canals, and that the skull be sufficiently well-cleaned, their anterior openings can usually be seen without difficulty. I have succeeded in tracing it throughout the Carnivora, Ruminantia, Pachydermata* and Edentata; it is always, at least in its posterior portion, wholly or partly enclosed by the true pterygoid bone, which constitutes the inner wall of the pterygoid fossa, so that the term "pterygoid canal," which has been applied to it in Human Anatomy synonymously with that of "vidian," is very correctly applicable. Its anterior opening is always just beneath that of the foramen spheeno-orbitarium, so that the issuing nerve can communicate readily with the second branch of the fifth pair, soon after its exit through the foramen rotundum. It may be further remarked, that the opening of the true vidian canal is always on the inner side of the foramen rotundum, while that of the ali-sphenoid canal is always on its outside, and usually covers and conceals it. However, I think I have removed all doubt by the dissection of a sheep's head, in which I have traced the vidian nerve from its junction with that of the seventh pair to the foramen in question; the course of the nerve is usually longer and more tortuous in the lower animals than in Man.

I have also perceived in some skulls belonging to the Marsupial order, a canal which from its situation seems to be the vidian; in the Rodent order, a distinct vidian canal seems rendered needless by the constant existence of a fissure communicating between the posterior nares and the apex of the orbit, and in some skulls I can even see faint indications of a groove extending from the foramen lacerum anterius round the inner side of the base of the pterygoid bone to the margin of the fissure; but I would not at present venture to deny the existence of a vidian canal in any species, considering that, with the exception of some Edentata, as the Armadilloes, in which its calibre is proportionally very large, it is extremely difficult to perceive in any small-sized animal.

It now becomes my task to place in an intelligible light, the observations on the crania of the Carnivora, which have led me to believe that the classification of this order may be set upon a firmer basis than that afforded by the characters generally made use of. In the course of the present disquisition, I must be allowed to consider this order exclusively of the Insectivora and Marsupials, which are by many naturalists included, the former indeed most usually, as part of the order in question. When the order Carnivora is thus circumscribed, we find it to consist of a very great number of species, being exceeded in that respect among the Mammalian class only by the Rodentia; and notwithstanding the striking difference of ex-

* In the justly celebrated work by Mr. Swan, on the Comparative Anatomy of the Nervous System, it is said that the Common Hog does not possess a distinct vidian nerve running in a bony canal; and certainly, I have not very clearly succeeded in demonstrating the canal in that species, but a skull in my collection of the *Sus Indicus* shows it very well; in the Babirussa, the anterior and posterior portions of the canal each open into the sphenoidal sinus, which has great extent in that animal.

ternal appearance that may be noticed among its members, so that we should anticipate but little difficulty in subdividing the order into a number of natural groups, the confusion, and differences of opinion that have existed, not only as to the manner in which the order should be divided, but also as to the position which certain forms should occupy, show sufficiently that the task is by no means an easy one; and when the structure of the different members of the order is investigated, and those forms are known to us by which the most strikingly different genera are blended one into another, it becomes difficult to draw the lines of separation, and still more to fix the characters by which the groups can with accuracy be distinguished from each other. In the present state of zoological science, it seems scarcely worth while to allude to the distinction of plantigrade and digitigrade, which though due to no less an authority than Cuvier, can hardly be said to possess any claims to the title of a philosophic distinction. Indeed the former of these divisions, if the character be fully insisted on, will include a very incongruous assemblage of forms.

It is upon the differences of the teeth that the subdivision of this order has been made chiefly to depend; but, although it does so happen that in most cases the affinities of a species may be truly predicated by the inspection of these organs, there are some in which naturalists have been led into error by too rigidly depending on them; it must be recollected that, especially in an order like this, where we find among the different species, every gradation between a purely carnivorous diet, and the capability of subsisting entirely on vegetables, the teeth, by the various degrees to which the different cusps are developed, and also by the point at which the normal development of true molars from behind may be arrested, present a very great variety in the amount of tubercular surfaces, or of trenchant edges, to suit the regimen of the species, without any necessary connection with its true affinities. For instance, the remarkable variation in the number of true molars presented by the different genera of the Dog-tribe is known to naturalists; and my own collection possesses the skull of a small dog in which, such is the arrest of development resulting from the shortening of the jaws, that although the individual was very old, it had never developed more than one true molar above and two below, or one behind the carnassial tooth in each jaw, being one less than is usual in the species.

If we except the aberrant family of Seals, we find that this order does not present so many of those very striking extremes of adaptive modification as are to be met with in some others, the generally lithe and active form prevailing through the order rendering a very moderate amount of adaptive modification necessary to fit the animal for almost any situation and mode of life, and from this cause it also happens that since the fallacious nature of the old division into plantigrade and digitigrade has been generally perceived, the classifications of this order most usually adopted by naturalists have approached much nearer to those natural divisions, which the essential

characters point out, than in many other orders; but at the same time, the general similarity of structure, to which I have before alluded, pervading the different modifications of form, has rendered it more than usually difficult to find characters truly essential, and independent of adaptive differences, on which to found truly natural subdivisions. These characters, when found in such an order as the Carnivora, we may fairly presuppose to be minute, and such of them as I have been able to discover, and which I have found to be constant so far as my opportunities of observation have extended, it is my object here to point out; with regard to the foramina, there is one which seems to be very characteristic of the order itself, since even in the true Bears, in which it does not exist as a canal, it is represented by a very well-marked groove. In other Carnivora it consists of a canal situated on the inner surface of the exoccipital bone usually running from before backwards and downwards; it gives passage to a vein; and if a special name should at any time be deemed requisite, perhaps that of exoccipital canal may be found suitable. The characters of which I purpose to make more or less use in the subdivision of the order, are the structure of the pterygoid bones and processes, the presence or absence of the ali-sphenoid canal, the form of the auditory bulla, and the course of the internal carotid artery through its canal, the structure of the mastoid and paroccipital processes, the situation of the foramen condyloideum, and to some extent, the structure of the lower jaw. It is by the fortunate circumstance of possessing in my own collection, crania representing all the leading divisions of the order, that I have been enabled, in the first instance, to remark the differences presented by the characters alluded to; but excepting a few genera, which I have been enabled to examine in the museums of the College of Surgeons and of this Society, it is only in the excellent series of skulls contained in our National Museum that I have been able to collect evidences of their constancy. Such being the limits of my opportunities of observation, it cannot be expected that I should give an opinion as to the precise zoological station of every one of the numerous genera; I will therefore take as a standard system the classification made use of in the List of Mammalia published by Mr. Gray, by order of the Trustees, since in the principal divisions it accords pretty nearly with my own ideas; simply pointing out where I find any genus whose cranium I have examined which I think requires to be altered in its position, and at the same time assigning to the divisions characters of my own, and expressing my opinion as to their rank.

Although in that classification the Bears are placed near the termination of the series, yet I believe it to be most usual to reverse the order and to begin with them; therefore I will first point out the characters which they present, and in so doing will confine myself to the genus *Ursus*, the subfamily *Ursina* of Mr. Gray. We here find no trace of a pterygoid fossa, the outer pterygoid process being closely pressed against the inner one, or true pterygoid bone, and sending off a strong lamina of bone to enclose the ali-sphenoid

canal, and, almost from its apex, a strong column of bone which runs backwards extending behind the foramen ovale, which it quite converts into a canal.

The auditory bulla, although, from the rough flat surface which it presents, it scarcely merits that name, yet may be perceived to show the same essential character as in the Weasels, which is, that it rises suddenly on the inner side at once to its greatest prominence, and is then flattened off towards the meatus, which is rather prolonged. The course of the internal carotid artery, as indicated by the canal excavated for it in the bone, is as follows:—it enters by a true *canalis caroticus* excavated in the bone of the ear, commencing quite behind, in the same fissure in which open the foramen jugulare and the aperture through which the *nervus vagus* issues from the skull, and extending forwards in a slightly arched direction again emerges anteriorly, and curving round, enters the cranium in a backward direction through a round foramen between the sphenoid bone and that of the ear, close to the aperture from which the Eustachian tube would issue, and corresponding to the foramen lacerum anterius; there is a distinct foramen glenoideum, although opening rather more inwardly than usual; the mastoid and paroccipital processes are both largely developed, and, owing to the very slight projection of the auditory bulla, stand out very distinct and prominent; the foramen condyloideum anterius occupies an exposed situation; the foramen condyloideum posterius I have never seen in any skull but the human, and there it is said to be sometimes wanting. The characters presented by the lower jaw in the Bears are essentially those most usual, though not quite constant, among the Weasel group; the angular process is pushed up very near to the condyle, and much flattened beneath; the form of the coronoid process is somewhat that of the true Weasels, but owing to the jaws being in the Bear more pushed forwards relatively to the situation of the cranial cavity than in the Weasels, this process is more pushed backward to meet the temporal muscle, which is spread over the sides of the cranium. With regard to the little process projecting beneath and anterior to the angle of the jaw, it is a mere superaddition, which appears again in the *Cercoleptes caudivolvulus* among the subursine group, and also in the *Otocyon Lalandii* and the *Nyctereutes procyonoides* among the Dogs, in these having the form of a large vertical lamina, projecting from the lower surface of the jaw; it is also seen like a second angular process in the Seal, so that I should not feel inclined to assign to it more than a generic value.

The small group of plantigrade Carnivora known to naturalists as the "Subursine group," I will reserve for consideration by and by, and proceed to characterize the Weasel group, the subfamily *Mustelina* of Mr. Gray.

In this group the pterygoid appendages very seldom manifest any tendency to form a fossa, although in many species the outer surface is rough and marked with ridges for muscular attachment; from behind is continued most usually a ridge which runs backwards and

outwards along the lower and posterior margin of the foramen ovale. This group is constantly marked by the entire absence of the ali-sphenoid canal. In the remaining characters this group presents no essential difference from the Bears; the commencement of the canalis caroticus is usually near the middle of the inner side of the auditory bullæ, and anteriorly the vessel does not again quite reach the outside of the cranium, simply showing itself at the point where it doubles, through the cartilage covering the foramen lacerum anterius. The characteristic form of the auditory bulla has been alluded to, and may be traced through the different modifications which it presents; these mostly depend simply on the size of the species, it being much more swollen in the smaller ones, and in the small species of true Weasel much elongated: the mastoid and paroccipital processes also are developed in relation to the dimensions of the species, or even the age of the individual; in the smallest species they have scarcely any projection, while in the larger ones they show the same essential structure as in the Bears, and different from that to be described in other groups. The peculiarities usually exhibited in this group by the lower jaw deserve some mention, even though not sufficiently constant to characterize the group, because some similar characters are seen in certain genera of the Viverrine section, which also show some approach to the Weasels in the characters of the base of the cranium, and therefore seem to be entitled in their own group to the place nearest the adjoining one. The characters in question are, that the coronoid process is rather more upright, and has less curvature than usual in the order, and the angular process is placed closer to the condyle, and is flattened beneath. The straightness of the lower margin of the jaw, alluded to by Mr. Waterhouse in a short communication published a few years ago in the Proceedings of the Society, I will consider by and by.

In the *Viverrine* group there is always a distinct indication of a true pterygoid fossa; the ridge by which it is bounded externally is, in the true Civets, cut off suddenly behind: in the *Paradoxuri* and allied genera it extends further, being blended with the walls of the ali-sphenoid canal, and in some species terminating laterally in a minute process. In the *Herpestine* genera, which are those most approaching to the Weasels, the true pterygoid bones are more extended backwards (which is most usually the case in that group, and also in the Bears), and the outer margin of the fossa is very suddenly cut off, as in the true Civets. With very few exceptions, the ali-sphenoid canal is present in this group: in the second edition of the '*Leçons d'Anatomie Comparée*,' the *Genets* are spoken of as wanting it; it exists however in the skulls that I have seen; the only exceptions that I have as yet met with are in the skulls of the *Rasse* (*Viverra malaccensis*) and of the small species of *Galictis*, recently described by Mr. Gray. In all the other characters, however, these crania indicate clearly the natural affinities. Had these exceptions been of the opposite kind, that is, had the ali-sphenoid canal been present in some species of a group in which it is usually absent, they might have been serious obstacles to the use of this character; but

since they seem to be merely instances of non-development of the bony lamina which should enclose the canal, I think we need not deprive ourselves of the assistance the character affords in the discrimination of groups; and further, I believe it will be found that by taking the aggregate of the characters I am here attempting to describe, the true affinities of any member of the order may without much difficulty be ascertained. The foramen glenoideum, when existing in this family, is of very small dimensions; the auditory bulla has very distinctly the appearance of being divided into two portions, of which the posterior is much the larger, and elongated in form: the more anterior division, which encloses the meatus auditorius externus, is much smaller, and partly overlapped by the other. In *Herpestes* and the genera allied to it the separation is rather less distinct, and the general form of the bulla partakes a little of that of the Weasels. The canalis caroticus is most frequently represented simply by a groove in the inner side of the auditory bulla, to give protection to the artery before it enters the cranium by the foramen lacerum anterius; but in most of the Herpestine genera it is protected by a closed canal, as in the Weasels. These genera, however, have a slight peculiarity of their own in respect to the entrance of the internal carotid artery, and that is, that after emerging from its canal it runs exposed for a short distance before finally entering the cranium. One of the most striking of the essential characters in this family is the structure of the paroccipital process; it is spread out, widened, and closely applied to the posterior surface of the auditory bulla, and the foramen condyloideum is by this means more or less concealed within the aperture of the foramen jugulare: these characters are very distinct in the Civets and Paradoxuri; in the Herpestine genera they are manifested a little less in degree, and the mastoid process is a little more extended, also spread over the auditory bulla, and blended with the paroccipital, so that the bony plate clothing, as it were, the posterior part of the bulla, has the appearance of being pushed a little towards the side.

The characters of the lower jaw, I before remarked, although not sufficiently constant in all cases to separate the groups, sometimes show interesting marks of affinity. In most of the genera of this group the coronoid process curves gently backwards as it rises, which is also its character in the Dogs, the Cats, the subursine group, and even in a few of the Weasels; but in the *Herpestes*, of whose approximation to the Weasels I have already mentioned so many indications, it presents that form of the coronoid process which characterizes most of the members of that group; and the angular process, although it is a salient process, as usual among the Civets, instead of being pushed up towards the condyle, yet shows that flatness on its lower margin which is more distinctly manifested in the Weasels and Bears than in any other sections of the order. The lower outline of the jaw has considerable curvature, both in *Viverra* and *Herpestes*.

Being of opinion that of the two remaining groups, the *Cats* approach the more nearly to the Civets, I will point out their characters

next. In them we still see more or less clearly the indication of a pterygoid fossa, but there is never any trace whatever of the ali-sphenoid canal, nor of the foramen glenoideum. The auditory bulla is always full and round, even in the largest species, in which however, as may be expected, it is proportionally less in size: in some species slight traces may still be discerned of the separation noticed in the *Viverræ*; the canalis caroticus is very minute: in this group the internal carotid artery itself is very small; the canal commences towards the posterior part of the auditory bulla, and never again appears at the outside, the foramen lacerum anterius being quite wanting. The characters of the paroccipital process are precisely those of *Viverra*, but its extent is much less, and the mastoid is rather more developed; the foramen condyloideum is concealed, just as in the Civets.

In a brief communication published by Mr. Gray in the 'Annals and Magazine of Natural History,' in which he describes a new genus of Dogs under the name *Cynalicus*, he very justly remarks, "the tubercular grinders are very variable in this tribe." I will now endeavour to point out some characters that can rather more safely be depended on. The pterygoid appendages have usually a deeper projection than in most other members of the order, and though marked with ridges on the outer side, these are scarcely sufficiently extended to form a fossa: the ali-sphenoid canal is a constant characteristic of the tribe; to this I have seen no exceptions, and should consider such a non-development as we have seen occasionally to occur in some of the smaller and more delicately constructed Civets less likely to happen among the Dog-tribe. The foramen glenoideum is always present and of large size. The auditory bulla is rather similar to that of the Cats, but usually a little flatter and not divided, and, like that of the Cats, is a little excavated towards the hinder and inner part, to form a considerable foramen lacerum posterius, in which open not only the foramina for the jugular vein and the nervus vagus, but the commencement of the canalis caroticus, which is of considerable size, and takes a course precisely similar to that of the Bear. The mastoid process is but moderately developed, but the paroccipital is very characteristic; its anterior edge is applied to the auditory bulla, but instead of being at all spread out, the process is laterally compressed and very salient, both in the vertical and backward direction. The foramen condyloideum occupies a very exposed situation, being upon the middle of a flat ridge which extends between the basi-occipital and the paroccipital process.

With the addition of the *Phocidæ* or Seal-tribe, the divisions which I have here attempted to characterize will correspond exactly to the six families proposed by Mr. Waterhouse in the paper before alluded to. It may however be very fairly questioned, whether a group whose members are so closely connected among themselves, and differ so little in essential characters, will justly admit of being divided into six sections, of so high a rank as the term 'family' is usually understood to imply. Mr. Gray, on the other hand, makes use of only two families, the *Felidæ* and the *Ursidæ*, including among the latter,

besides the true Bears, only the genera *Procyon*, *Nasua*, *Cercoleptes*, and *Ailurus*. I must confess that I cannot concur with him in including the subfamily *Mustelina* among the feline family, and at the same time separating the Bears from them as a separate family; for the course of my observations has convinced me that the Weasels are decidedly more closely allied to the Bears than to any other members of the order. Numerous genera have at various times been one after another abstracted from the Bear-tribe, and added to that of the Weasels, until at length only the four that I have mentioned have remained associated with the Bears. Some remarks in Mr. Waterhouse's paper seem to imply considerable affinity between the Weasels and the Cats. He observes, "The Cats appear to bear the same relation to the *Mustelidæ* as the Dogs to the *Viverridæ*." This may be, but I should not consider that relation a very close one. He alludes particularly to the straightness of the lower jaw as a common character of the two groups: in the first place, I would remark, that this character is by no means constant among the Weasels; and secondly, that it is merely a circumstance of form, resulting from other adaptive modifications of the form of the entire cranium, such as the relative length of the jaws, and the development, both in size and number, of the molar teeth. As the posterior termination of the molar series is always on a rather lower level than the glenoid cavity, and as the line of the dental series inclines regularly upwards and forwards, it follows, that for the incisors of the lower jaw to close with those of the upper, the lower jaw must be curved in proportion as the jaws are lengthened.

Among the characters which I have pointed out in the base of the cranium, it will be seen that the only tangible distinction between the Bears and the Weasels is the presence of the ali-sphenoid canal in the former, and its constant absence in the latter. Much as I have insisted upon the importance of this character as assisting to distinguish groups, I do not consider it sufficient alone to entitle the groups which it separates to the rank of *families*; neither am I prepared to admit the difference of the teeth sufficient for that purpose, these being, as I before observed, merely adaptive modifications. In the true Bears the number of true molars is on each side *two* above, and *three*, the full normal number, below. In the Weasels it is only *one* above and *two* below. In the subursine group, to which I must add the *Bassaris astuta* of North America, it is *two* above and *two* below; and among these it is only the *Ailurus fulgens*, an Indian species, which possesses the ali-sphenoid canal; while the other four genera, namely *Procyon*, *Nasua*, *Cercoleptes*, and *Bassaris*, all American forms, agree among themselves in possessing the general characters common to the Bears and the Weasels, and in having no ali-sphenoid canal, and two true molars on each side in each jaw. The *Bassaris astuta* has most usually been placed among the Viverine section, in which it also appears in the list published by Mr. Gray; but doubts have at various times been entertained as to that being its true station. Mr. Waterhouse remarks, in a note appended to the paper from which I have before quoted, "From an examination

of the external characters of *Bassaris astuta*, it appears to me that it belongs to this (the subursine) group ;” and Mr. Blyth, in the translation of Cuvier’s Animal Kingdom, mentions the *Bassaris* immediately after the *Cercoleptes*, and in a note very justly observes, “Strong presumptive evidence that the Basset (*Bassaris*) does not appertain to the Viverrine group is afforded by the restriction of the geographic range of the latter to the eastern hemisphere in every other instance. The presence or absence of a cæcum would decide the question.” I am not aware whether this last-mentioned point has ever been ascertained, but from the characters presented by the cranium, I do not feel the slightest hesitation in referring this animal to the subursine group. It is true that the teeth have some resemblance to those of the *Viverræ*, but this only results from the greater or less development of different cusps, being an adaptation to a more carnivorous diet. The bony palate terminates more anteriorly than is usual in the Weasels, but this circumstance only depends upon the greater or less extension of a bony lamina, and I think is of but little moment : the pterygoid appendages are rather feebly developed.

If then we constitute the Bears and Weasels one family, *Ursidæ*, which I think the essential characters, however small they may appear, will readily warrant us in doing, we can then avail ourselves of the ali-sphenoid canal and the adaptive modifications of dentition to subdivide it into four subfamilies, namely *Ursina*, including only the true Bears, and characterized by the presence of the ali-sphenoid canal, and of two true molars on each side above and three below ; the very remarkable genus *Ailurus*, of India, will of itself constitute a second subfamily *Ailurina*, having also the ali-sphenoid canal, but only two true molars below. In the third subfamily, *Procyonina*, I would include *Procyon*, *Nasua*, *Cercoleptes*, and *Bassaris*, an entirely American group, distinguished by the absence of the ali-sphenoid canal and the same number of true molars as *Ailurus* ; and lastly, the extensive group of *Mustelina*, characterized also by the absence of the ali-sphenoid canal, and having only one true molar on each side above and two below.

Of the remaining groups, I have already expressed my opinion that the Cats and the Civets are the most nearly allied to each other. Among the characters which I have assigned to them will be found differences by which they may be distinguished from each other ; but in the most remarkable and the greatest number of characters they differ chiefly in degree. To each of these has been referred in turn the group of Hyænas, usually considered as allied to the Cats ; but Mr. Waterhouse urges that the *Viverræ* have the stronger claim to this aberrant genus. From the characters of the cranium, I should consider it as rather more approaching to the Cats. In all skulls of the Hyæna that I have seen, the ali-sphenoid canal is wanting, although in the second edition of Cuvier’s ‘Leçons d’Anatomie Comparée’ it is affirmed that this canal (there called the vidian canal) is present, and that the author possessed a skull in which it existed on one side but not on the other. The roundness and want of division of the auditory bulla and the minuteness of the canalis caroticus approximate the Hyæna

to the Cats; in all the characters common to the Cats and Civets the Hyænas also agree. However, if these three groups be united, as I think would be justified by the characters, the difficulty in a great measure will be overcome. Three subfamilies will then constitute the family *Felidæ*; the *Felina* are characterized by the absence of the ali-sphenoid canal, the very minute size of the canalis caroticus, the absence of the foramen glenoideum, the auditory bulla having but little or no trace of division, and the molar series consisting of only three premolars and one true molar on each side above, and two premolars, with one true molar, below. The next subfamily, *Hyænina*, presents, as I have just before pointed out, the same cranial characters as the Cats, but it differs, as is well known, in the dentition. The largest subfamily of the *Felidæ*, the *Viverrina*, possess in general the ali-sphenoid canal, and sometimes a minute foramen glenoideum; the auditory bulla is more or less distinctly divided into two portions; the canalis caroticus is of average dimensions, although not always completely enclosed, and is placed towards the anterior part of the bulla, and the artery, after having passed through the canal, shows itself externally before finally entering the cranium: the dentition is on each side usually four premolars and two true molars, both above and below. The very singular genus *Proteles* has the cranial characters common to the Cats and Hyænas: from the dentition, so singularly modified by arrest of development, but little evidence of zoological affinity can be adduced; I should therefore be rather inclined to consider it a modified Hyæna, since in the external characters it so closely resembles the animals of that genus.

The Dogs, or the subfamily *Canina* of Mr. Gray, remain, and I think must constitute a separate family *Canidæ*; they all agree precisely in those cranial characters which I have pointed out, and notwithstanding the variation in the number of the true molars, do not seem to admit of division into subfamilies. It is rather remarkable that in the different genera of this family we find precisely the same variation in the number of the true molars as in the subfamilies of the *Ursidæ*; as, setting aside the genus *Otocyon*, in which they are developed, we may almost say, beyond their normal number, there are *two* above and *three* below in the genera *Canis*, *Vulpes*, *Nyctereutes*, and *Lycaon*, as in the *Ursina*, *two* above and *two* below in the genus *Cyon*, as in the subfamilies *Ailurina* and *Procyonina*, and only *one* above and *two* below in *Cynalicus*, which is the number found in the Musteline group. This being the case, on first looking at the imperfect skull of the *Cynalicus* in the British Museum, which unfortunately exhibits only the anterior portion, I was led for a moment to suspect that the true place of this remarkable genus might be among the Weasels, and was the more led to this idea from the circumstance that the animal, in proportions and in colouring, bears a remarkable resemblance to the *Galera barbara*, also an inhabitant of South America; but on more attentive examination I perceived, that not only did the last molar resemble precisely the penultimate in the Dog, but sufficient remained of the skull to show, in the form of the pterygoid appendage, and the presence of the ali-sphenoid canal,

characters decisive against the musteline, and in favour of the canine group. And subsequently Mr. Waterhouse kindly pointed out to me, in that department of the Museum which is entrusted to his care, a fossil cranium from Brazil, which, from being found associated with jaws evidently belonging to that species, is most probably referable to the same, and in this I found that all the characters of the base of the cranium were precisely those of the Dogs.

Although I have not had sufficient opportunities to enable me to offer anything original on the other parts of the anatomy of the Carnivora as bearing upon their classification, perhaps I may be allowed to mention a few known circumstances, which, as they co-exist (so far as is yet known) with the characters which I have pointed out in the three families *Ursidæ*, *Felidæ*, and *Canidæ*, may serve to indicate that the importance I have assigned to those characters is not altogether undeserved. The presence or absence, and the structure of the cæcum have frequently been made use of in determining the limits of groups; and I need but to remind my readers, that in the Weasels, as well as in the Bears and the subursine animals, the cæcum is wanting, and there is little or no distinction between small and large intestine; also that it is in the Cats, in the Hyæna, and the Viverrine section, that this separation is well-marked, and a small or but moderate-sized cæcum is appended. In the Dog, the large intestine is but very little larger than the small intestine, but the separation is marked by a constriction, and by the addition of a cæcum remarkable for the curious manner in which it is several times folded upon itself. There are two other portions of the organization to which I will also allude, as affording characters serving to distinguish the three leading families; and in so doing I take the facts as I find them in the 'Leçons d'Anatomie Comparée,' stated simply, and evidently without any intention of assigning to them any zoological importance. First, with regard to the accessory glands connected with the generative organs of the male: the vesiculæ seminales are wanting throughout the order, unless it be in the Coati-mondi, which Cuvier mentions among the animals possessing them: this solitary exception, if so it be, seems to require confirmation; unfortunately the only two Coati-mondis it ever fell to my lot to examine were both young females. The prostate is spoken of as forming in the Bear, and in the Otter, the Weasel and other "vermiformes," only a layer more or less thick around the commencement of the urethra, while in the Ichneumon, the Cats, the Dogs, the Hyæna, and the Civets, it is salient, differing however in size and the number of its lobes; and Cowper's glands are wanting in the Bear, the Raccoon, the Otter, and other "vermiformes," and also in the Dogs, but exist in the Ichneumon, the Civet, the Hyæna, and in the Cats.

The larynx is an organ whose differences of structure are very likely to afford useful zoological characters when studied with that view. Cuvier, after describing the structure it presents in the Dogs, where the most striking characters seem to be the considerable development of the cuneiform cartilages, their S-like shape, and

their continuity with the borders of the epiglottis, proceeds to point out the differences presented by that of the Cats, and briefly observes, "Le Mangouste et la Civette ont la glotte comme les Chats." He then describes a third variety of structure presented by the Bears, and mentions differences in the Raccoon, the Badger, the Marten, the Otter, and the Coati, consisting merely of variations presented by the chordæ vocales, and in some the superaddition of sinuses, doubtless only adaptive modifications to the different kinds of voice.

In the foregoing observations nothing has been remarked with reference to the Seals, nor indeed is it absolutely necessary; for the limits of a group, so distinctly marked and peculiarly modified, are never at all likely to be mistaken; but as this singular family is truly and essentially a portion of the order whose arrangement it is here my endeavour to elucidate, a few observations upon them may seem a little called for. Naturalists have long been accustomed to separate from the rest those which are distinguished externally by the presence of the small external ear, and the long riband-like processes of skin projecting from the toes of the hind-feet. These genera, *Otaria* and *Arctocephalus*, are also in their cranial characters the most distinctly separable from the rest, through which, with the exception of the Walrus, a great uniformity prevails, so that a mention of the characters in which the common Seal differs from those having external ears may perhaps suffice. Here there is no trace of a postorbital process, nor of an ali-sphenoid canal; the mastoid can scarcely be said to constitute a process; it is swollen, and appears to form a portion of the auditory bulla, more or less connected with the tympanic portion, from which it is separated by a depressed groove running from the stylo-mastoid foramen backwards and a little inwards. The paroccipital process is never large in any of the family, but it is always distinctly developed, and salient backwards. The *Arctocephalina* group are distinguished at once by their having a distinct postorbital process and an ali-sphenoid canal; the mastoid projects as a strong process, and seems, as it were, to stand aloof from the auditory bulla, which is small and rounded. The carotid canal has precisely the same course as that pointed out in the Bears and Dogs, while in the common Seal it enters rather more forward, and does not show itself again externally. The *Arctocephalina* have the orbito-sphenoids much compressed together anteriorly to the optic foramina, which almost appear to have coalesced into one: they are also remarkable for the strong development of a process on the anterior part of the rim of the orbit; this however will not well serve as a character, since it is apparent, though in a much less degree, in some of the larger species of the ordinary type, as the *Stenoryhynchus leptonyx*. The Walrus is a peculiar form which I should deem it advisable to constitute a distinct subfamily, since I cannot concur with Mr. Gray in associating with it the *Halichærus gryphus*, whose skull presents all the characters of the true Seals, the elevation in the nasal portion having no relation whatever with the immensely swollen upper jaw of the Walrus, which is necessitated by the enormous size of the canine teeth: in this animal there is no postorbital

process, but that on the anterior rim of the orbit is very strongly developed; there is also an ali-sphenoid canal whose outer wall is very thick; the mastoid is a large thick process, projecting very much as in *Arctocephalus*, but its surface is for the most part continuous with that of the flattened auditory bulla.

If we adopt all the five subfamilies into which this family is divided in the list published by Mr. Gray, the Walrus, and the *Arctocephaline* group, which differ so decidedly from the other Seals, would almost seem entitled to the rank of families; but rather than so completely dismember such a well-marked group as that of the Seals, I should feel disposed to assign to the differences of the teeth no more than a generic value, and to restrict the number of subfamilies to three,—the *Phocina*, *Trichecina*, and *Arctocephalina*, including in the latter the genera *Otaria* and *Arctocephalus*, the Walrus alone constituting the *Trichecina*, and all the other Seals falling under the first-named section.

I cannot conclude without offering some apology for the length of my communication, more particularly as the number of minute details of form alluded to may render it a little tedious, and among the facts enumerated the number is so small that possess any claim to be considered new; but if I have to any extent succeeded in placing in a clearer light the mutual affinities of the different genera of Carnivora, a subject of which I think all will admit the difficulty, or if I have but brought into its due importance any character, however small, which may render the determination of a fragment more easy to the palæontologist,—if I have achieved but a very small share in the important task of elucidating those real affinities existing throughout nature, which must, when completely made out, render classification not a mere alphabet of reference for the determination of species, but a key to higher generalizations, I trust that my labours have not been thrown away, and that my apparent prolixity may be overlooked.

In offering the annexed synopsis with a view to render the arrangement I would propose more readily comprehensible, I must observe, first, that the lists of genera include only those whose crania I have examined, and therefore I must not be considered as rejecting any that I have omitted, nor do I pledge myself to adopt all that are inserted. Secondly, that the difficulty of expressing in a manner sufficiently decided, and at the same time sufficiently brief for a synoptical form, the characters I have made use of, has compelled me to omit some of them. In order to place the *Herpestine* genera of the *Viverrine* subfamily in juxtaposition with the *Weasel* group, it is advisable that the series of terrestrial Carnivora should either commence with the Bears and terminate with the Dogs, or *vice versa*; and as I have not seen in the Seals anything which, in my opinion, warrants their approximation to any of the other families more than to another, it matters little which mode be followed.

Fam. URSIDÆ.

Auditory bulla rising suddenly on its inner side, and more or less flattened off towards the meatus.

Paroccipital process prominent, and neither flattened on the surface of the auditory bulla, nor laterally compressed.

Foramen condyloideum exposed. A considerable foramen glenoideum.

No cæcum. No Cowper's glands.

Prostate gland not salient, being contained in the thickened walls of the urethra.

Subfam. URSINA. (Of general geographical distribution.)

A distinct ali-sphenoid canal.

Internal carotid artery reappearing externally after passing through its canal, and doubling back to enter the cranium.

True molars on each side $\frac{2}{3}$.

Ursus (including the subgenera).

Subfam. AILURINA. (Confined to India.)

A distinct ali-sphenoid canal.

True molars on each side $\frac{2}{2}$.

Ailurus.

Subfam. PROCYONINA. (Confined to America.)

No ali-sphenoid canal.

True molars on each side $\frac{2}{2}$.

Procyon.

Cercoleptes.

Nasua.

Bassaris.

Subfam. MUSTELINA. (Of general geographical distribution.)

No ali-sphenoid canal.

True molars on each side $\frac{1}{2}$.

Arctonyx.

Grisonia.

Meles.

Galera.

Taxidea.

Vison.

Mydaus.

Mustela.

Mephitis.

Martes.

Gulo.

Helictis.

—
Lutra.

Mellivora.

Fam. FELIDÆ.

Auditory bulla rounded, frequently showing indications of being divided into two parts.

Paroccipital process flattened, and applied to the back part of the auditory bulla.

Foramen condyloideum more or less concealed. Foramen glenoideum very small or wanting.

Cæcum small or moderate, simple. Cowper's glands present. Prostate gland salient.

Subfam. VIVERRINA. (Confined to the old world.)

A distinct ali-sphenoid canal (with very few exceptions*).

Auditory bulla distinctly subdivided.

Canalis caroticus distinct, though sometimes only as a groove.

True molars on each side $\frac{2}{2}$.

Galictis.

Ryzæna.

Cynictis.

Herpestes.

—

Arctictis.

Cynogale.

Paradoxurus.

—

Prionodon.

Genetta.

Viverra.

Subfam. HYÆNINA. (Confined to the old world.)

No ali-sphenoid canal.

Division of auditory bulla scarcely perceptible.

Canalis caroticus indistinct, or very small.

True molars on each side $\frac{1 \text{ or } 0}{1}$; premolars on each side $\frac{4}{3}$.

Proteles.

Hyæna.

Subfam. FELINA. (Of general geographical distribution.)

No ali-sphenoid canal.

Division of auditory bulla slightly, or scarcely perceptible.

Canalis caroticus indistinct, or not perceptible.

True molars on each side $\frac{1}{1}$; premolars on each side $\frac{3}{2}$.

Felis.

Fam. CANIDÆ.

A distinct ali-sphenoid canal. A considerable foramen glenoideum.

Auditory bulla rounded, not divided.

Internal carotid artery reappearing externally after passing through its canal, and doubling back to enter the cranium.

Paroccipital process laterally compressed, foramen condyloideum exposed.

Cæcum folded upon itself. No Cowper's glands. Prostate gland salient.

Cynalicus.

Cyon.

Lycaon.

Canis.

Vulpes.

Nyctereutes.

Otocyon.

* The exceptions that I have seen are the Rasse (*Viverra malaccensis*) and a species of *Galictis*.

Fam. PHOCIDÆ.

Molars all similar in structure. (The general characters need not here be enumerated, being universally known.)

Subfam. ARCTOCEPHALINA.

A postorbital process. An ali-sphenoid canal.

Mastoid process strong and salient, standing aloof from the auditory bulla.

Otaria.

Arctocephalus.

Subfam. TRICHECINA.

No postorbital process. A distinct ali-sphenoid canal.

Mastoid process strong and salient, its surface continuous with the auditory bulla.

Trichecus.

Subfam. PHOCINA.

No postorbital process. No ali-sphenoid canal.

Mastoid process swollen, and seeming to form part of the auditory bulla.

Morunga.

Cystophora.

Halichærus.

Ommatophora.

Lobodon.

Leptonyx.

Stenorhynchus.

Phoca.

ROYAL SOCIETY.

Jan. 18, 1849.—“On the Development and Homologies of the Carapace and Plastron of the Chelonian Reptiles.” By Professor Owen, F.R.S.

The author commences by defining the several parts of which the osseous thoracic-abdominal case of the Chelonian Reptiles is composed, and briefly discusses the several opinions that have been published with regard to their nature and homologies, dwelling chiefly on that recently proposed by Prof. Rathke, in his work on the Development of the *Chelonia*, in which it is contended that the carapace consists exclusively of the development of parts of the endo-skeleton, viz. the neural spines and vertebral ribs (*pleurapophyses*), agreeably with the opinion of CUVIER and BOJANUS, and that the remainder of the thoracic-abdominal case, consisting of the “marginal pieces” and “plastron,” are formed entirely from bones of the dermal system.

Adverting to the hypotheses of Cuvier, Geoffroy and Meckel, that the thoracic-abdominal case is a modification of parts of the endo-skeleton exclusively, the author tests their determinations by comparisons with the corresponding parts of the bird and crocodile, and infers, from the latter animal, that the hyosternal, hyposternal and xiphisternal bones are not parts of the sternum, but are homologous with the hæmapophyses (sternal ribs and abdominal ribs); those in the

Plesiosaurus making the nearest approach to the peculiar development of the parts in the *Chelonia*, especially as they appear in the plastron of the immature *Terrapenes* and Sea-turtles.

Admitting that any hypothesis framed from the comparison of the completed structures in the adult Vertebrata requires for confirmation its agreement with the important phenomena of the development of those structures, the author proceeds to apply that test.

He details his observations on the development of the skeleton, and especially of the thoracic-abdominal case, in the embryos and young of different genera of *Chelonia*. The chief facts that have governed his conclusions are the following:—

With respect to the carapace. The cartilaginous basis of the neural plates is developed in the substance of the derm; and of these, the 9th, 10th, 11th, and the 'nuchal' plate are ossified from independent centres, and remain permanently free from ankylosis with the subjacent spines of the vertebræ: they are, therefore, "dermal bones," homologous with those that overlies the vertebræ of the crocodile. But the first to the eighth neural plates inclusive are serial homologues with the foregoing, and must, therefore, have the same general homology. The objection that ossification extends into their dermal cartilaginous basis from the neural spines is met by the remark, that other parts, *e.g.* the radius and ulna of the frog, are ossified from a common centre, without their homological distinctness being thereby masked or destroyed. The course or starting-point of ossification does not determine the nature and homology of parts, and the author refers what he believes to be an erroneous conclusion of Prof. Rathke to undue value being given to the character of connation.

The cartilaginous basis of the costal plates is developed in the substance of the derm; the subjacent ribs are previously ossified and present the normal slender form. But ossification extends from near the head of each of the eight pairs of dorsal ribs, from the second to the ninth pair inclusive, into the superincumbent dermal cartilages. This had been described as the development of the tubercle of the rib. But Prof. Owen observes that, in the development of the carapace of the young of the *Testudo indica*, the connation of the costal plate with the rib commences at a different point in each rib alternately, and appears to be governed by the arrangement of the horny scutes above. Another objection to these ossific expansions being the tubercles of the ribs is presented by their abutment medially against the neural plates, not against the vertebral diapophyses, as in the bird and crocodile.

In regard to the development of the plastron, the author describes two situations in which the primitive cartilages are developed, corresponding with those in the embryo-carapace, viz. one belonging to the endo-skeleton, the other in the derm. The first form under which the endo-skeletal parts of the plastron appear agrees with the evidence afforded by the comparison of the fully-developed parts with those of the crocodile, and proves the hyosternals, hyposternals and xiphisternals to be 'hæmapophyses' or abdominal ribs: the

hyosternals and hyposternals are primitively long, slender, transverse bars, which join the vertebral ribs in the Tortoises and Terrapenes, without the intervention of any marginal pieces. The ossification of the superadded dermal portions proceeds from the previously ossified endo-skeletal elements.

The author concurs with M. Rathke in regarding the marginal pieces as 'dermal bones,' and concludes by a full discussion of the facts and arguments which have led him to a different conclusion respecting the nature and homologies of the carapace and plastron.

The memoir is illustrated by figures of the carapace and plastron, and of the corresponding segments of the skeleton in the bird and crocodile, and of the development of the thoracic-abdominal case in land- and sea-chelonians.

BOTANICAL SOCIETY OF EDINBURGH.

March 8, 1849.—Professor Balfour, President, in the Chair.

The following communications were read:—

1. "On the mode of Growth in *Calothrix* and the allied genera," by John Ralfs, Esq. (See p. 348 of the present number.)

2. "On the Cone-like Bodies produced by *Epilobium palustre*," by James Hardy, Esq.

This paper describes the fleshy buds or hybernacula formed at the ends of the scions of some species of *Epilobium*, and which constitute a mode of propagation for those plants independently of the seed. The author notices more especially those of *E. palustre*, which he describes as resembling minute larch-cones, and formed of smooth, fleshy, orbicular reniform or cordate scales. The basal pair is small, the following ones suddenly enlarged, the apical ones small. They are imbricated in pairs alternately. In the autumn their connection with the parent plant is dissolved, and they lie loose on the spongy soil until the spring, when they produce roots and form new and distinct plants.

3. "On Varieties of some common Plants," by James Hardy, Esq.

The author describes a state of *Scabiosa succisa* with the involucre small, the heads loose and few-flowered, the external segment of the corolla much lengthened, stigma and stamens short. Found in Penmanshiel Wood, Berwickshire. He next notices two forms of *Leonodon Taraxacum* [*Taraxacum officinale*] founded chiefly on the forms of the leaves, characters quite unworthy of confidence in that genus. Of *Rumex crispus* he remarks that each of the petals bears a tubercle when the plant grows near the sea, and only one of them when inland. [This seems to be a generalization from insufficient data.] A variety of *Sonchus oleraceus* is founded on the presence of glands on the involucre, flower-stalks very downy when young, leaves lyrate-pinnatifid and usually destitute of spines. It is "maritime and is rarely found beyond the influence of the sea." [We have before us several specimens of *S. oleraceus* to which these characters will more or less apply, but only one of them is maritime. Gaudin is the only author with which we are acquainted who notices a plant (his *β. glan-*

dulosus) having "caule summo pedunculisque glanduloso-hispidis," which we believe to be the plant before us and that found by Mr. Hardy. Of the above characters the gland-tipped hairs are alone of any value. To have down at the base of the involucre is probably a frequent condition of *S. oleraceus*, not of *S. asper*. The form of the leaves is too inconstant to be of any value.]

4. Dr. Balfour described a specimen of *Stiffia chrysantha*, one of the arborescent Compositæ of South America, which had recently flowered in the Edinburgh Botanical Garden. Also a specimen of *Quassia amara*, which had shown flowering racemes. The leaves of the latter presented remarkable transitions from a simple to a pinnate leaf, with a winged petiole. Notices of these will appear in the 'Edinburgh New Philosophical Journal.'

April 12.—Professor Balfour, President, in the Chair.

The following communications were read:—

1. "Algæ Orientales" (part 8), by Dr. Greville. In this communication Dr. Greville described *Sargassum gracile*, *S. leptophyllum*, and *S. flexile*. This paper will appear in the 'Annals of Natural History' and in the Society's Transactions.

2. "On the Irritability of the Style of various species of *Goldfussia*," by J. S. Sanderson, Esq. In this paper Mr. Sanderson entered into a detailed statement of the structure of the style of *Goldfussia*, and endeavoured to show that the explanation given by Morren of the cause of the movements is not satisfactory.

The style of *Goldfussia* curves outwards, the stigmatic papillæ occupying the convexity of the curve. The irritability resides in the papillæ. The change produced by irritation consists—1st, in the disappearance of the curve, the style being brought into the straight position; 2nd, in its being curved in the opposite direction to a greater or less extent. In the moving part of the organ, or that corresponding to the stigmatic surface, the arrangement of the parts is the same as in *Mimulus*. An elastic epidermis covers the surface opposite to that occupied by the stigmatic papillæ. The vessels and cylindrenchymatous tissue are interposed, the former being in apposition to the epidermis, the latter occupying the remainder of the space. Spiral vessels contribute to the elasticity of the stigma.

The cylindrenchyma appears to be the tissue in which the changes are produced, giving rise to the irritability. The true stigma of *Goldfussia*, like that of *Mimulus*, consists of a surface presenting conical papillæ, in connexion with which are the cylindriform cells, which are continuous with those forming the general conducting tissue of the style. In *Mimulus* and in *Goldfussia anisophylla* each cylindriform cell terminates in a papilla. Hence Morren deduces an explanation which he considers tenable, and which he gives as the conclusion to be drawn from his researches. He supposes that the motion of the style depends on a sudden transference of the granules which are lodged in the papillæ to the opposite extremities of the cylindrical cells. This phænomenon he believes to be dependent on

a property of irritability resident in the granules themselves. Mr. Sanderson endeavoured to show that, in certain species at least of *Goldfussia*, it is impossible that any such motion of the granules can take place, as the necessary condition, viz. the continuity of the cylindric cells with the papillæ, is absent. After giving a description of the different layers of cells of the style, and showing the complete separation of the papillæ of the stigma from the cylindrenchyma of the style, the author concludes, that from these facts it is evident that no change of the position of the granules can, in the instances adduced, cause any alteration in the position of the stigma, and that there seems every reason for supposing that the change produced by irritation is confined to the external series of cells which in *Goldfussia*, as in *Mimulus*, have the property of resisting the tendency which the organ has, from the elasticity of the epidermis, to curve inwards on the application of a mechanical or chemical stimulus.

3. "On the mode of Growth in *Nostochineæ*," by John Ralfs, Esq.

4. "Remarks on some Mosses found near Penmanshiel," by John Hardy, Esq. The author stated that he had ascertained that 148 species of moss occurred within a short walk of Penmanshiel, being nearly as many as Dr. Dickie finds within ten miles of Aberdeen.

5. Dr. Balfour made some observations on the structure of *Lyrp*, a peculiar, hairy, scale-like matter found on the leaves of *Eucalyptus dumosa*. This substance is considered by Newport to be caused by the attack of an insect. The nature of it is still involved in much uncertainty. It has been analysed by Dr. Anderson, and is found to contain a large amount of sugar. The hairs which surround the cup-like bodies are marked with striæ, which converge in a peculiar manner towards a space running along the tube. The tubes contain granular and amylaceous matter, which becomes blue by the addition of iodine, but the hairy matter surrounding the cochineal insect does not do so. The subject is under investigation by Dr. Anderson; and Mr. Cay, who transmitted the substance from Australia, is expected soon to send specimens of the plant with the substance attached, so as to enable botanists to determine its nature more decidedly.

6. Dr. Balfour stated that he had observed the following plants in flower at the Bridge of Allan, near Stirling, during the first week of April :—

Draba verna; *Sisymbrium thalianum*; *Capsella Bursa-pastoris*; *Cardamine hirsuta*; *Ranunculus Ficaria*; *Caltha palustris*; *Cerastium triviale*; *Viola odorata*, in great profusion in the woods behind the village; *Potentilla Fragariastrum*; *Ulex europæus*; *Sarothamnus Scoparius*; *Ribes Grossularia*; *Oxalis Acetosella*, Keir; *Taraxacum officinale*, and cut-leaved variety; *Tussilago Farfara*, going out of flower; *Senecio vulgaris*; *Bellis perennis*; *Lamium maculatum*, woods at Keir; *Lamium purpureum*; *Nepeta Glechoma*; *Primula vulgaris*; *Primula veris*; *Veronica hederifolia*; *Ulmus montana*; *Narcissus Pseudo-narcissus*, woods at Keir, probably introduced; *Galanthus nivalis*, almost completely out of flower; *Luzula pilosa*, Keir; *Poa annua*; *Prunus*

spinosa; *Anemone nemorosa*, Keir woods; *Montia fontana*; *Geranium molle*; *Equisetum arvense*, in fructification; *Viola canina*; *Mercurialis perennis*; *Corylus avellana*; *Luzula campestris*; *Luzula sylvatica*, flowers beginning to expand; *Chrysosplenium oppositifolium*; *Cerasus avium*, Kippenross; *Cheiranthus Cheiri*, Dunblane Cathedral; *Salix caprea*; *Salix cinerea*.

Besides these, he noticed the occurrence of *Valeriana pyrenaica*, *Sedum Telephium*, and *Convallaria majalis* in the same district, but not in flower.

7. Dr. Balfour exhibited a flowering specimen of *Quassia amara*, from the Botanic Garden, and gave a description of the various parts of the flower. He also showed a specimen of *Cinnamomum nitidum*, which was in flower in the Botanic Garden, and made remarks on the distinctions betwixt it and *C. eucalyptoides*, with which it has been confounded. The plant figured as *C. nitidum* in Hooker's 'Exotic Flora' and in Hayne's Plates is *C. eucalyptoides*. A description of these plants will appear in the 'Edinburgh New Philosophical Journal.'

8. Dr. Balfour exhibited a fine specimen of dry rot (*Merulius lachrymans*) on a plank several feet in length, taken from a cellar at Holyrood Palace.

9. Mr. Stark exhibited specimens of the following woods, and made some short remarks upon them, viz.:—

Kydia calycina, used in clarifying sugar; *Myrica cerifera*, Candleberry Myrtle; *Ficus indica*, Banyan tree; *Achras bullata*, remarkable for its rapid growth and the density of its wood; *Paulownia imperialis*, *Nerium Oleander*, *Rhododendron arboreum*, *Araucaria braziiliensis*, *Citrus vulgaris*.

MISCELLANEOUS.

Observations on the Geology and Natural History of Mexico.

By W. H. PEASE.

HAVING noticed among the published correspondence from the army in Mexico but little information respecting the natural features of that country, I take the liberty of presenting to the Academy the result of a few hasty observations made on a part of the route from Vera Cruz to the city of Mexico. But few opportunities for scientific investigations were afforded to those connected with the army, on account of the active operations they were incessantly engaged in, from the time of leaving the coast until the return of the army. I was enabled however, principally in company with scouting parties, to visit that part of the country between the range of volcanos, bounding the plains of Perote and Puebla on the east, and the Gulf of Mexico, comprising the greater part of the State of Vera Cruz, and to make some collections in natural history.

The general outlines of the country I presume it is unnecessary for me to detail. The plains of Cuetlachlan, or the *tierra caliente*, as they are more usually called, comprise that region of country bor-

dering the Gulf of Mexico. They are about twenty-five miles in width, extending back to the Plan del Rio by a gradual ascent of thirty feet per mile, with but few elevations or depressions, except at the river Antigua, and other small streams which pass through them in a north-easterly direction. Beyond the Plan del Rio the ascent increases over a regular succession of hills and plains, until you reach the foot of the range of mountains in which the peaks of Orizaba, Perote and others are situated. This range forms the rim or eastern boundary of the plains of Anahuac, which are more commonly known as the *tierra templada*, and are about thirty-five miles in width. The sides and top of this mountain-range are called the *tierra fria*, immediately beyond which lie the great table-lands of Mexico.

The table-lands extend, with little or no variation in their general level, to the Cordilleras bordering the Pacific Ocean, though they are divided into several plains by ranges of volcanos and porphyritic rocks.

The *tierra caliente* is bordered on the Gulf of Mexico by low sand-hills, from four to six miles in width, not bare, as has been represented, but covered with a thick chapparel, or thicket of Cacti and thorn-bushes, to within reach of the water. Great numbers of freshwater and land shells are found on these hills and on the beach, thrown up from the Gulf, which may be referred to living species.

After passing these hills a few miles, I noticed at one locality a layer of limestone. It is covered by a coarse conglomerate of volcanic and porphyritic rocks, which extends over the whole upper part of the *tierra caliente*, rendering the surface rough and stony. At the Puerta Nacional it is exposed to the depth of 200 feet, interstratified irregularly with veins of fine sandstone. Deep gullies are worn through it to the rivers, by the drainage of the plains during the wet season. The rivers are the only source of irrigation, receiving no supplies in their course from the mountains to the coast.

The greater part of the plains is covered with a dense growth of vegetation, so thick that it would seem almost impossible for the soil to support more, and the trees and bushes are loaded with an innumerable variety of parasitical plants and vines, interlacing and binding them together in such a manner as to render them absolutely impenetrable. On other parts, particularly between the conglomerate and the coast, the chapparel is more open, dotted with clumps of low dwarfish trees and Cacti, and affords grazing to herds of half-wild cattle, in which the property of the inhabitants principally consists. To the south of Vera Cruz the cultivation of cotton has been introduced; it is of white fine quality, but perhaps, from want of proper cultivation, the staple is very short, so that when worked it requires to be mixed with other varieties.

The inhabitants live mostly on the small bottom lands of the rivers, their crops consisting of corn, chili, and frijoles. They are a puny and sickly people, being subject to intermittent and typhoid fevers during the months after the close of the wet season. Though the

temperature at the Puerta Nacional, in the months of September, October and November, averaged 80° at 3 p.m. with little variation, the atmosphere was so loaded with moisture that it was impossible to keep our fighting-tools free from rust for twenty-four hours at a time, protect them as we might.

The animals met with at the Puerta Nacional and on the tierra caliente, are for the greater part common to Texas and the north; the common deer is abundant, though of small size; the red fox, the prairie wolf, and the spotted tiger-cat are frequently met with, and the Puma also, though more frequently in the mountains above. Reptiles are exceedingly numerous, though of few species. The royal iguano, as it is called, is found in the cliffs bordering the river Antigua, and grows to a very large size; one killed by a Mexican measuring nine feet in length. The flesh of this species, as well as that of others, is considered quite a delicacy by the inhabitants. I observed a curious habit of a species of lizard, which has not been noticed before to my knowledge; it is that of passing over the water in an erect position, resting on its hinder parts, and propelling itself by its hind-feet, its tail lying horizontally on the water, acting as a rudder. In the San Juan and Antigua rivers I noticed an alligator which appeared to be different from our common species; the young, a specimen of which I caught, is entirely black, without the usual yellow markings on its back.

Land and freshwater shells are scarce, the beds of the streams being very stony; nearer the coast, however, they may perhaps be more abundant. After passing the tierra caliente, the ascent increases over the tierra templada, as above stated, to the foot of the mountains. The whole of the surface of this part of the country is much broken by low ranges of volcanic hills and deep ravines or barrancas, as they are called, of 200 to 500 feet in depth, which run commonly at right angles from the mountain-chain above. The city of Jalapa derives its name from that of an ancient Indian village a few leagues distant, and signifies "built among barrancas."

Most of the hills are of volcanic formation, though they are not all so, as I have seen stated. The limestone shows itself in the valleys at the foot of the mountains, and in the barrancas, when of sufficient width: it is, of course, very much altered from its connexion with the volcanic rock, being uncrystallized and whitened: it is not fossiliferous, and, as far as I noticed, unstratified. At Quarterpec, a few leagues south of Jalapa, and at other places, it is burnt by the Indians, and the lime is sold in the neighbouring towns and cities.

The soil of the valleys is rich, and under cultivation produces during the whole year, rice, coffee, tobacco, sugar-cane, corn and other vegetable productions, fruit, &c. of both tropical and temperate climes, in great abundance. The average of temperature I should place lower than Humboldt. During the months of January and February there were several nights of severe frosts in the neighbourhood of Jalapa and below, which stripped the trees on the hills of their foliage, but I was told it was of very unusual occurrence.

Every one who has visited this country must agree with Humboldt, that the region comprising the tierra templada and the eastern slope of the mountains above, is "one of the most beautiful and picturesque in the world." No other part of the world, perhaps, can present scenery of such sublime and picturesque beauty. When travelling over the rough and barren hills, strewn with volcanic rocks, the scene is suddenly changed by coming upon the edge of a barranca or ravine, its bottom lands several hundred feet below you, highly cultivated in fields of sugar-cane, corn, &c., dotted with the straw-thatched cottages of the Indians, and presenting a most perfect panorama or picture of nature's own painting, inclosed, as it were, in a frame of black and jagged rocks, which form its perpendicular sides, without a vestige of vegetation growing upon them. Far off below lies stretched out the tierra caliente, having the appearance of an immense park, bounded on the horizon by the Gulf; and yet, elevated as your position seems to be, on turning to look in the opposite direction, Orizaba, with its silvery cap of eternal snow, and the base and rocky peak of Perote, still stand above you eight or nine thousand feet.

In addition to the animals on the tierra caliente, I noticed the raccoon, the opossum, the *Bassaris astuta*, or ring-tailed weasel, as it is called by the Mexicans, and several species of deer. I noticed also a porcupine, which struck me as different from the common species. The puma and jaguar are also met with in the mountains.

The mammalia of this part of Mexico seem to be identical with, or nearly allied to, more northern species, while the birds for the greater part are found also much farther south. Lizards are less numerous, but snakes more so, than on the tierra caliente. The plants I should think more characteristic than either mammalia or birds, and present a rich field for investigation.

The two species of Jalapa-root are collected in small quantities, only on the sides of the mountains, by the Indians, the greater part exported being brought from the north and west of the city of Mexico.

In the neighbourhood of Jalapa, and on the road passing over the mountains, I noticed several beds and hills of sand, in some of which are deposits of the sulphate of lime, finely crystallized in the form of sand. I was told by the Mexicans that they had dug up here young clams, perhaps *Cyclas*. I mention this fact in confirmation of my opinion, that the plains of Anahuac above, or of Perote and Puebla, as they may be called, have been drained by one of the many revolutions (geological, not political) which this country has passed through.

The eastern part of the plains above, for the distance of twelve or fifteen miles, is sandy; beyond are salt-beds and soda. In many localities, at the depth of ten or twelve feet, I saw fossil freshwater shells of the genera *Planorbis*, *Lymnea*, *Physa*, and others, which it is reasonable to suppose once lived at the bottom of lakes which covered these plains, as well as that of the valley of Mexico.

The volcanic mountains which form the boundaries to the plains

are flanked by ranges of limestone hills, similar in character to those below on the tierra templada. Undoubtedly the range which bounds the plains of Anahuac to the east is very rich in mineral treasure, as specimens of silver ore are frequently brought in by the Indians, but they, like those of Peru, conceal their knowledge of the localities with the utmost care. About three leagues from Perote I saw a vein of sulphuret of silver three feet in width, associated with blende and sulphate of copper.—*Proceedings of the Academy of Natural Sciences of Philadelphia*, vol. iv. p. 91.

METEOROLOGICAL OBSERVATIONS FOR MARCH 1849.

Chiswick.—March 1. Cloudy: clear and windy: cloudy. 2. Fine: cloudy: clear. 3. Overcast. 4. Clear: cloudy and fine: clear. 5. Fine: frosty. 6. Frosty: fine: overcast. 7. Cloudy: boisterous, with rain at night. 8. Fine: hail-shower: clear and frosty at night. 9. Clear and frosty: very fine: slight snow. 10. Clear: cloudy. 11, 12. Overcast throughout. 13. Fine. 14. Cold dusky haze. 15, 16. Overcast. 17. Foggy: fine: clear. 18. Foggy, with heavy dew: hazy: foggy and damp. 19. Foggy: overcast. 20. Dusky haze: overcast: clear. 21. Overcast: clear. 22. Foggy: cold haze: overcast. 23. Overcast: cold haze: densely overcast. 24. Fine, but cold: clear and frosty at night. 25. Snowing: cloudy and cold: overcast. 26. Densely clouded. 27. Dry haze. 28. Foggy: overcast throughout. 29. Hazy: rain: cloudy. 30. Heavy showers. 31. Clear: fine: cloudy.

Mean temperature of the month	41°·56
Mean temperature of March 1848	42°·43
Mean temperature of March for the last twenty years	42°·62
Average amount of rain in March	1·36 inch.

Boston.—March 1. Cloudy: rain A.M. and stormy. 2. Cloudy. 3. Fine. 4. Cloudy. 5, 6. Fine. 7. Fine: rain P.M. 8. Cloudy: snow P.M. 9, 10. Fine. 11. Cloudy. 12. Fine. 13. Fine: rain early A.M. 14—16. Cloudy. 17. Fine. 18, 19. Foggy. 20—22. Cloudy. 23. Cloudy: rain P.M. 24. Snow. 25. Cloudy. 26. Fine. 27. Cloudy. 28. Rain: rain A.M. 29. Cloudy: rain P.M. 30, 31. Fine: rain P.M.

Applegarth Manse, Dumfries-shire.—March 1. Fair and clear A.M.: getting cloudy: rain P.M. 2. Fair A.M.: showers. 3. Fair: wind rising. 4. Fair: cloudy: fine sunset. 5. Slight shower: cleared. 6. Fair: cloudy: high wind P.M. 7. Rain all day, but light. 8. Frost hard: clear all day. 9. Frost keen. 10. Frost increasing in keenness. 11. Frost slight: shower. 12. Fine spring morning: got colder. 13—17. Fine dry weather. 18. Very fine day. 19. Still finer, like May. 20. The same, beautiful weather. 21. The same: fog P.M. 22. Frost during the night: fine day. 23, 24. Fine, though dull. 25. The same: brighter. 26. Frost: dull P.M. 27. The same dullness: no frost. 28. Clear and cool. 29. Shower early. 30. Showery. 31. Slight drops of rain: slight frost.

Mean temperature of the month	41°·8
Mean temperature of March 1848	41°·2
Mean temperature of March for twenty-five years	39°·1
Rain in March 1848	4·1 inches.
Rain in March for twenty years	2·3 „

Sandwick Manse, Orkney.—March 1. Bright: hail: light showers. 2. Cloudy: showers. 3. Cloudy: clear. 4. Clear: showers. 5. Sleet: showers. 6. Showers. 7. Sleet: snow-showers. 8. Snow-showers. 9. Drift: snow-showers. 10. Thaw: showers. 11. Rain: drizzle. 12. Cloudy: snow. 13. Snow-showers: thaw. 14. Drizzle. 15. Fog: damp. 16. Fog: fine. 17. Fine: fog. 18, 19. Fog. 20. Fine: clear aurora. 21. Fine: cloudy. 22. Fog: cloudy. 23. Rain. 24. Damp: drizzle. 25. Drizzle: aurora. 26. Sleet-showers: clear aurora. 27. Cloudy: showers. 28. Cloudy: clear aurora. 29. Cloudy. 30. showers. 31. Damp: clear.

Days of Month.	Barometer.					Thermometer.				Wind.				Rain.			
	Chiswick.		Dumfries-shire.		Orkney, Sandwick.		Chiswick.		Boston.	Dumfries-shire.		Orkney, Sandwick.	Chiswick.	Boston.	Dumfries-shire.	Orkney, Sandwick.	
	Max.	Min.	9 a.m.	9 p.m.	9 a.m.	8 p.m.	Max.	Min.		Max.	Min.						
1849. March.			8 a.m.														
1.	30.026	29.426	29.02	29.43	29.46	29.31	49	39	38.5	45.5	23	40.5	42	nw.	sw.	.....	.13
2.	30.283	30.126	29.70	29.73	29.40	29.65	51	34	35	48	39	41	46	sw.	w.	.....	.24
3.	30.461	30.366	29.95	30.10	29.92	29.93	53	41	43	49	39	47	47.5	sw.	w.	.....	.05
4.	30.459	30.447	30.00	30.18	29.92	29.81	58	29	47	48.5	43	50	47	sw.	sw.	.....	.18
5.	30.605	30.457	29.98	30.15	29.96	30.01	54	26	48.5	48	42.5	42	42	sw.	swsw.	.....	.12
6.	30.618	30.280	30.14	30.31	29.80	29.76	55	41	47	47	37	47	48	sw.	w.	.....	.16
7.	30.062	30.879	29.50	29.55	29.29	29.58	54	38	47	46	41.5	35.5	35	w.	n.	.06	.02
8.	29.918	29.810	29.46	29.69	29.63	29.74	49	23	41	48.5	29	32	30	sw.	nw.	.02	.26
9.	29.949	29.917	29.50	29.82	29.93	30.15	43	29	32	42	25.5	33.5	33	n.	n.	.01	.20
10.	30.432	30.276	29.95	30.23	30.22	30.04	43	24	33	42	23.5	41	41	n.	n.	.....	.09
11.	30.424	30.271	30.05	30.10	29.85	29.64	46	36	39.5	45.5	34	44	46	w.	sw.	.....	.15
12.	30.164	30.128	29.70	29.95	29.97	29.92	56	43	47	52	43.5	41.5	33.5	calm	calm	.....	.04
13.	30.302	30.030	29.60	29.90	30.12	30.22	59	36	52	45	45	34.5	37	sw.	calm	.....	.09
14.	30.308	30.268	29.90	.....	30.04	30.04	50	40	41	.....	.....	43.5	46	sw.	w.	.09	.09
15.	30.312	30.292	29.93	.....	30.12	30.14	53	45	48	.....	.....	46.5	46.5	calm	w.	.....	.14
16.	30.337	30.309	29.88	.....	30.18	30.21	57	28	50	.....	.....	46.5	44.5	calm	w.	.....	.10
17.	30.306	30.201	29.93	.....	30.15	30.09	59	30	42	.....	.....	46	41	calm	w.	.....	.02
18.	30.159	30.057	29.71	.....	29.90	29.96	49	38	43	45	.....	44	40.5	ese.	ese.	.01	.....
19.	30.042	30.025	29.67	29.85	29.90	29.90	51	26	41.5	51	41.5	44	42	ese.	ese.	.....	.....
20.	30.242	30.108	29.80	30.00	29.99	30.10	46	27	41	55.5	37.5	47	44	e.	w.	.....	.....
21.	30.300	30.231	29.90	30.15	30.14	30.14	53	26	46	57	41	48	43.5	sw.	sw.	.....	.....
22.	30.197	30.086	29.82	30.13	30.12	30.15	42	39	41.5	56.5	32.5	43	41.5	e.	sw.	.....	.....
23.	30.037	29.979	29.70	30.13	30.00	30.15	40	30	43	50	39	45	42	ne.	s.	.....	.12
24.	29.986	29.955	29.65	29.94	29.96	29.98	44	27	38	44	38	44	42	n.	s.	.10	.06
25.	29.914	29.907	29.67	30.05	29.87	29.96	40	33	38	43	34	47.5	43	ne.	sw.	.01	.10
26.	29.896	29.842	29.60	29.89	29.83	29.79	43	32	40	52	38	40.5	35	ese.	ese.	.....	.12
27.	29.570	29.351	29.21	29.40	29.35	29.67	45	34	41	48	36	41.5	39	calm	e.	.....	.13
28.	29.399	29.250	29.04	29.40	29.50	29.85	45	38	41	43.5	37	41.5	38	ne.	ne.	.14	.08
29.	29.385	29.343	29.10	29.40	29.24	29.66	51	29	45.5	41	36.5	43	38	e.	e.	.14	.13
30.	29.433	29.280	29.00	29.18	29.21	29.46	52	29	44	49	34	43	38	sw.	ese.	.16	.12
31.	29.607	29.560	29.20	29.33	29.35	29.42	59	34	47	55	38	43.5	43	s.	se.	.30	.04
Mean.	30.103	29.982	29.65	30.230	29.850	29.858	50.09	33.03	42.5	48.2	36.8	42.79	41.14	0.85	1.50	0.27	2.71

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XLIV.—*On the British species of Plumbaginaceæ.* By CHARLES C. BABINGTON, M.A., F.L.S., F.G.S.*

THE publication of the 12th volume of DeCandolle's invaluable 'Prodromus,' in which the description of the *Plumbaginaceæ* by M. E. Boissier is contained, has again drawn my attention to our native species included in that order, upon which I formerly bestowed considerable study, but without arriving at any satisfactory result. With the help of Boissier's descriptions I have now re-examined all the British specimens which I have been able to obtain, and although the result is far from being such as I could have wished, still it seems desirable to place it before botanists in order that their attention may be turned towards these plants, and thus some definite conclusion may perhaps be obtained.

1. ARMERIA, Willd.

Boissier does not seem quite satisfied concerning the permanency of some of the characters upon which the species of *Armeria* are founded, and it must be confessed that the result of my examination of our plants has not tended to increase any little dependence that I placed upon them. The characters to which I refer are those taken from the relative lengths of the pedicels and calyx-tubes, and the presence of hairiness upon the angles alone of the latter or over its whole surface.

I have however thought it desirable to characterize the possible species by employing distinctions derived from those parts as well as from others, in order that they may correspond with the species adopted in the 'Prodromus.' I shall then notice two other specimens of which I am in possession; and also make a few remarks upon a possible mode by which the supposed species might be combined if the doubtful characters were neglected.

* Read before the Botanical Society of Edinburgh, Feb. 8th, 1849.
Ann. & Mag. N. Hist. Ser. 2. Vol. iii.

ARMERIA, Willd.

Sec. 2. PLAGIOBASIS. § 1. HOLOTRICHÆ, Boiss.

Tubus calycinus totus et ad costas et ad costarum intervalla pilosus.

1. *A. maritima* (Willd.); *foliis* linearibus obtusiusculis uninerviis *planis* glabris vel parce ciliatulis, *scapis* villosulis, *involucris phyllis* latis obtusisque, *dorso late herbaceis* exterioribus dorso excurrente acutiusculis, reliquis late scarioso-marginatis muticis, *pedicello calycinum tubum æquante*.

A. maritima, Willd. *En. Berol.* i. 333; *DeCand. Prod.* xii. 677.

The leaves of this plant are numerous, thin, rounded at the end, usually much shorter than the scape, but sometimes of half its length. The outer involucral bracts are ovate, and have on their backs a broad green herbaceous band extending to a little beyond their summit where it forms a strong and short mucro. The inner bracts are also furnished with the dorsal green band, but in them it terminates abruptly at some distance below the end which is similarly scarious with the sides. The calyx-tube is very thickly clothed with hair both on its angles and in the hollows between them; it is about as long as the limb which has short acute lobes each furnished with a slightly excurrent rib forming a short awn.

Boissier states that he has seen specimens of this plant from England and Ireland, and that it inhabits the maritime districts of northern and middle Europe. He does not quote any figure of it, nor am I aware that any exists, for that contained in 'Eng. Bot.' doubtless represents *A. pubescens*, to which also belong most of my specimens preserved under the name of *A. maritima*. The only specimens to which I can satisfactorily apply the name of *A. maritima* were gathered in Jersey in June and July 1837 and 1838 by myself, and near Chichester, Sussex, by the Rev. W. W. Newbould in 1842.

2. *A. pubigera* (Boiss.); *foliis* linearibus obtusiusculis uninerviis *subtriquetris superne subcanaliculatis punctulatis* facie inferiori obtuse carinatis, *scapis* pubescentibus, *involucris phyllis* pallide brunneis *scariosis* dorso incrassatis exterioribus cuspidatis, reliquis latis obtusis apiceque scariosis, *pedicellis tubo calycis dimidio brevioribus*.

A. pubigera β. *scotica*, Boiss. in *DeCand. Prod.* xii. 678.*A. maritima*, Bab. *Iceland Plants in Ann. Nat. Hist.* xx. 33.

The leaves of this plant are shorter than those of *A. maritima*, and their sides are so far folded together as to cause them to appear to be very narrow. The outer involucral bracts are blunter than those of the preceding plant, but have a more slender and acute point. My specimens do not afford me conclusive evidence of the presence or absence of a dorsal green band, but the bracts

are certainly thickened, and were perhaps green in that part similarly to those of *A. maritima*. The calyx-tube is not so thickly hairy as in the preceding plant, but is similarly covered throughout with hairs; it is about as long as the limb, which has very short acute lobes terminating in longer awns than those of *A. maritima*.

Boissier places our plant (which he has seen from the island of Staffa alone) as the variety *scotica* of his *A. pubigera*, with which species, if I am correct in supposing that my specimens are the same plant, it does not very well accord. *A. pubigera* appears to be only known in cultivation and is stated to be "tota dense pubescens," and its involucrel bracts are described as "omnino scariosis." In our plant the pubescence is far from being dense, on the leaves it is very thin and scattered, and the involucre is quite glabrous. The latter part also cannot be described as "omnino scariosum," for its bracts are certainly much thickened on the back, and present the appearance of having been green there.

My specimens vary greatly in size, but are doubtless states of one species. They were obtained at Southampton in June 1827, Tintagel, Cornwall, July 1839, by myself; at West Wittering, Sussex, in Nov. 1843, by the Rev. W. W. Newbould; Folkestone, Kent, by Mr. W. Pamplin; and Tenby, Pembrokeshire, by Mr. F. J. A. Hort.

The plant gathered near Reikiavic in Iceland in July 1846 is undoubtedly of this species.

§ 2. PLEUROTICHÆ, Boiss.

Tubus calycinus ad costas tantum pilosus, intervallis costarum glabris.

* Spiculæ intra involucrem sessiles.

a. Folia inter se subconformia.

3. *A. pubescens* (Link); *foliis* linearibus uninerviis *planis* glabris puberulisve, *scapis* pubescentibus, *involucri* phyllis dorso late herbaceis exterioribus triangulari-ovatis acutis, reliquis latis obtusis et scarioso-marginatis muticis, *pedicello calycinum* *tubum æquante*.

A. pubescens, "Link in *Rep. Nat. Cur. Berol.* i. 180;" *DeCand. Prod.* xii. 680.

Statice Armeria, *Eng. Bot.* t. 226.

Leaves short, usually much shorter than the scape, bluntly pointed or sometimes even on the same plant acute. The outer involucrel bracts are different in shape from the others, but do not exceed them in length. The tube of the calyx is perfectly glabrous between the prominent hairy ribs; it is about as long as the limb, and has very broad short and acute lobes with the

rib extending to the end, but it can scarcely be considered as excurrent.

I believe this to be a frequent inhabitant of salt marshes and the sea-shore, perhaps more common in Britain than the *A. maritima*, which it very greatly resembles. My low-country specimens (from Montrose and Dolgelly) have scapes of 5 or 6 inches in length and leaves from 1 to 3 inches long. It is also frequently found on mountain tops, and has been mistaken in Britain for *A. alpina*, which is a totally different plant. On mountains the scapes are usually, but not always, considerably shorter than in plants growing near to the sea, and the pedicels are shorter than the calyx-tube, often not above half its length. In other respects they correspond. I possess two curious specimens, gathered upon the exposed summit of Croghan mountain in the isle of Achil in Ireland, in which the leaves are hardly half an inch long and the scapes do not exceed an inch in length.

In addition to the above-mentioned specimens from Achil I have the alpine plant before me from Caernarvonshire (Snowdon and Glyder), Cumberland (Helvellyn), Yorkshire (Wensley Dale), Aberdeenshire (Ben na Bourd), and Orkney.

It may justly be doubted how far this plant has claims to be considered as a distinct species from *A. maritima*. The peculiar clothing of the calyx-tube in each seems to be the only tangible point of difference between them.

4. *A. duriuscula*; foliis linearibus obtusiusculis uninerviis subtriquetris superne subcanaliculatis facie inferiori obtuse carinatis pilosis, scapis pubescentibus, involucri phyllis dorso late herbaceis exterioribus triangulari-ovatis acutis, reliquis latis obtusis et scarioso-marginatis muticis, pedicello calycinum tubum subæquante.

Leaves short, about half as long as the scape, folded in a similar manner with those of *A. pubigera*, but more slender. The outer involucre bracts are much narrower than the others, and very similar to, but shorter than, those of *A. pubescens*. The tube of the calyx is quite glabrous between the prominent hairy ribs, it is about as long as the limb, and has broad short very acute lobes with the midrib scarcely extending to the end.

I have been unable to identify this plant with any of the species described by Boissier, and am therefore forced to consider it as new. It greatly resembles *A. pubigera*, but its leaves are not punctured on the upper surface, its involucre bracts are broadly herbaceous on the back, its calyx-tube is not uniformly pilose, its calyx-lobes are not awned, and its pedicel is longer. To our other species it bears a very slight resemblance, and is at once distinguished from them by its leaves.

I am indebted for my specimens to my friend Mr. F. J. A.

Hort, of Trinity College, Cambridge, who gathered it on the Tors near the sea at Ilfracombe, Devonshire, in July 1848, by whom the specific name was suggested.

5. *A. plantaginea* (Willd.); foliis lineari-lanceolatis 3-5-nerviis margine anguste membranaceis, scapis glabris scabris, involucri phyllis exterioribus triangularibus lanceolatisve cuspidatis in alabastro juniori capitulum superantibus, reliquis ovatis obovatisque membranaceo-marginatis obtusis, pedicello vix tubo calycis dimidio æquante.

A. plantaginea, Willd. *En. Berol.* i. 334; *DeCand. Prod.* xii. 683; *Eng. Bot. Suppl.* t. 2928.

The broader leaves furnished with more than one nerve distinguish this plant from our other species. It is remarkable that Boissier describes the pedicel of this species as equalling the calyx-tube, whereas I have never found it to equal the half of that part in length, and that he combines with it the *A. scorzonrifolia* (Willd.), to which Koch awards a pedicel shorter than half the calyx-tube.

Our only station for this plant is the island of Jersey.

Having described all the supposed species which are known to be natives of Britain, I proceed to make a few remarks upon two specimens preserved in my herbarium which I am unable to refer to either of the above, and do not feel myself justified in naming even as probable new species.

1. A plant gathered at Trewavas near Marazion in Cornwall, in July 1839.

This accords in most respects with *A. pubescens*, but has quite glabrous scapes, ovate and scarcely acute outer bracts, and very short petioles. Its heads also are remarkably small. Had not so much stress been laid upon such differences as these by Boissier and others who have a far more extended knowledge of the genus than I possess, I should have unhesitatingly placed this as a form of *A. pubescens*, and it is only a deference for high authorities that even now prevents me from doing so. It exactly resembles some of the smaller states of that plant.

2. A plant found on the shores of the Gare Loch in Dumbar-tonshire in Aug. 1838 by the Rev. Churchill Babington.

This also agrees very closely with *A. pubescens*, and is probably a variety of it. It differs solely in having its spikelets shortly but distinctly stalked within the involucre. This character is employed to distinguish a subsection by Boissier, and is therefore doubtless deserving of attention.

I may now remark, that of the above supposed species *A. maritima* and *A. pubescens* most closely resemble each other, their outermost bracts differ slightly in form, and the latter has its calyx-tube pilose only upon the prominent angles, the interstices being

quite glabrous. As far as I have myself had an opportunity of observing, the latter character appears to be constant ; but should such prove not to be the case, and I beg to call particularly the attention of botanists to it, then they might very well be combined under the name of *A. maritima*, the older although far from being the better name.

If we now consider the other two doubtful species (for *A. plantaginea* cannot be questioned), *A. pubigera* and *A. duriuscula*, we shall find that if the herbaceous back of the bracts, a doubtful point as far as our plant is concerned, be neglected, the latter differs from the former by having longer pedicels and a pilose-striate calyx-tube. The character derived from the length of the pedicels is apparently so far constant as not to allow of its being neglected until greater evidence of its variability is obtained. I trust that I may be allowed to recommend this point also to the attention of botanists who have an opportunity of examining the living plants. On the distinction founded on the calyx-tube no further remark is necessary.

It does not appear that we are in a position to overthrow the characters upon which Boissier has founded his sections, and until such is the case we must recognize these four plants as distinct species, although I have a very strong suspicion that they really constitute only two.

2. STATICE, *Linn.*

I now proceed to attempt to bring the nomenclature of our species of *Statice* into conformity with that used in the 'Pro-dromus.' In accordance with Boissier's views, which I am inclined to adopt, all our species will alter their names with the exception of *S. Limonium*, and one will be added to their number. Our plants form part of the section *Limonium* (Boiss.) and will stand as follows.

1. *S. Limonium* (Linn.); foliis elliptico-oblongis mucronatis uninerviis venosis basi in petiolum attenuatis, scapo subtereti superne corymbosis, *spiculis* 1-3-floris ascendentibus *in spicas* secundas *patentes vel recurvas* distiche et dense congestis, calycis limbo propter denticulos minutos inter lobos majores integros acutos sitos subdecemlobo, bractea exteriori parva dorso herbaceo carinato excurrente.

S. Limonium, *Eng. Bot.* t. 102 ; *DeCand. Prod.* xii. 644.

S. Behen, *Drej. Fl. Hafn.* 122 ; *Fries, Summa Plant. Scand.* 200.

S. Limonium, 1. *Scanica*, *Fries, Nov. Fl. Suec. Mant.* i. 10 ; *Mant.* ii. 17.

Scape usually not branching in its lower half, often not until near the corymbose summit. Spikes short. Spikelets densely imbricated. Outer bract acute, with an excurrent herbaceous

point and a white or brownish membranous margin ; inner twice or three times as long, white and membranous at the sides and blunt or emarginate or split summit. Leaves blunt with a mucro and wavy at the edges, or acute and mucronate and scarcely at all wavy.

Muddy salt marshes on the English coasts. Is it found in Scotland or Ireland ?

2. *S. Bahusiensis* (Fries) ; foliis oblongo-lanceolatis mucronatis uninerviis venis inconspicuis in petiolum decurrentibus, scapo subangulato ramosissimo paniculato, *spiculis* 1-3-floris secundis distantibus *in spicas arrectas vel incurvatas laxè dispositis*, calycis limbo propter denticulos minutos inter lobos majores denticulatos acutos situs subdecemlobo, bractea exteriori parva dorso herbaceo subexcurrente.

S. Bahusiensis, *Fries*, "*Herb. Normale*, iii. 18 ;" *Summa*, 200 ; *Decand. Prod.* xii. 644.

S. Limonium, 2. *Bahusiensis*, *Fries*, *Nov. Fl. Suec. Mant.* i. 10 ; *Mant.* ii. 17 (excl. syn.).

S. rariflora, *Drej. Fl. Hafn.* 121 ; *Reich. Fl. exsic.* 2200 ; *Eng. Bot. Suppl.* t. 2917.

Scape nearly always branching from near its base, not at all corymbose, and although much divided below, the ultimate subdivisions (or spikes) are long and simple. Spikelets often only 1-flowered, quite distinct, not imbricated. Outer bract broad, cuspidate or acute, with a slight mucro and a white membranous margin usually deeply tinged at its base with pink ; inner twice as long, very blunt. Leaves usually blunt with a mucro from, or from just beneath, the extremity, nearly even at the edges.

Inhabiting less muddy places than *S. Limonium*, and found throughout the United Kingdom.

A few observations upon the name of this plant are necessary. Boissier has adopted that employed here, owing probably to Fries's observation in his '*Summa Plant. Scand.*' (200) : "*e prioritatis lege hæc species S. Bahusiensis, sub quo nomine sex annos ante Dreyerum descripsi et in H. N. distribui, dicenda est.*" At a first view this would seem most conclusive, but on a more careful examination it appears that the name was given in the '*Mantissa altera*' (anno 1839) to the plant as a species having been used for the sake of distinction, but apparently not specifically, in the '*Mant. prima*' (1832). As unfortunately I am not in possession of the '*Herb. Normale*,' iii., I do not know if the plant was there considered as a species or variety (although from the remark already quoted probably as the former), nor the date of its publication. Drejer published his '*Flora Hafn.*' in 1838, and has therefore the priority if the second '*Mantissa*' is the origin of the name *S. Bahusiensis* used specifically ; but if it was so used

in the 'Herb. Norm.' it is then probable that it is the older name, and its use there is a sufficient publication to give it the claim "prioritatis lege."

3. *S. Dodartii* (Gir.); foliis obovato-spathulatis basi trinerviis et in petiolum alatum decurrentibus, scapis rigidis rectis alternatim ramosis, *ramis sterilibus nullis*, spiculis 2-4-floris in *spicas* lineares *crassas* subverticales distiche et dense imbricatis, calycis limbo 5-lobo denticulis intermediis nullis : lobis obtusis integris.

S. Dodartii, Girard in *Ann. Sc. Nat.* ser. 2. xvii. 31. t. 4; *DeCand. Prod.* xii. 648.

Limonium minus bellidis minoris folio, *Dodart, Mem.* ed. 1676, p. 95.

Scape usually not branched in its lower half in our plant; branches often simple, short. Outer bract acute; inner twice as long, obovate-elliptical, obtuse; both with white diaphanous margins faintly tinged with pink. Leaves blunt with a small mucro usually from just below the extremity.

Rocky shores. Berry Head, Devon, *Miss A. Griffiths*. Langeland Bay and Pennard, Glamorganshire. Giltar Head, Pembrokeshire.

4. *S. occidentalis* (Lloyd); foliis lanceolato-spathulatis acutiusculis basi obscure trinerviis et in petiolum alatum longe attenuatis, scapis gracilibus flexuosis fere a basi dichotome ramosissimis, *ramis inferioribus nonnullis sterilibus*, spiculis 2-4-floris in *spicas tenues* suberectas lineares distiche imbricatis, calycis limbo 5-lobo denticulis intermediis nullis : lobis obtusis integris.

S. occidentalis, Lloyd, *Fl. Loire inf.* 212; *DeCand. Prod.* xii. 648.

S. Dodartii β . *humilis*, Gir. *Ann. Sc. Nat.* ser. 3. ii. 326.

S. lanceolata, Reich. *Iconog.* t. 719. f. 961.

S. cordata, G. E. Smith, *Pl. of S. Kent*, 18. t. 2.

S. reticulata, Hook. *Fl. Scot.* i. 97.

S. binervosa, G. E. Smith in *Eng. Bot. Suppl.* t. 2663.

Scape usually branching quite from its base; branches repeatedly forked, elongated. Outer bract acute; inner twice as long, obovate-cuneate, obtuse; both with a deep pink band at the base of the white diaphanous margin. Leaves often rather acute, with a small mucro usually from below their extremity.

On the chalk cliffs of Kent. Shingly places near Cley next the sea, Norfolk. Cliffs at the Mull of Galloway. Near Dublin, *Dr. Tyacke*. Cliffs near St. Helier's, Jersey; and in Alderney. St. Martin's, Guernsey, *Rev. W. W. Newbould*.

This is doubtless the *Limonium minus* of Ray (*Syn.* ed. 3. 202), the *L. parvum* of Gerard (*Herb.* 332; *Em.* 411) as supposed by the Rev. G. E. Smith, for the figure given by the latter author after Lobel (*Icon.* 291) can represent no other known British species. The sterile branches show that it is not intended for any variety of *S. Limonium*, as was supposed by Smith. It is

much to be wished that some competent botanist would inform us what is the *Statice* which grows "upon the chalkie cliffe going from the towne of Margate downe to the sea side, upon the left hand," for that is the only place where Gerard found his plant. Dillenius (Ray's Syn. ed. 3. 202) adds Ramsgate and Harwich as stations for it.

It seems clear that the *S. spathulata* (Desf.) obtained "in rupibus maritimis Barbariæ ad la Calle," of which Boissier has seen an authentic specimen, is quite distinct from the *S. spathulata* of British authors (see DeCand. Prod. xii. 649); and after a careful examination of our plants I am satisfied that Boissier is correct in supposing that two species are included under the *S. spathulata* of Hooker, and that they are the *S. Dodartii* (Gir.) and *S. occidentalis* (Lloyd). I have not seen French specimens of the former, but can have no doubt of its identity with our plant after comparing it carefully with M. de Girard's elaborate description (Ann. Sc. Nat. ser. 2. xvii. 31), although there are a few slight discrepancies. I am possessed of a good specimen of the *S. occidentalis*, through the kindness of M. Lenormand of Vire, and find it to accord precisely with the other form called *S. spathulata* by us. As also I am possessed of an authentic specimen of the *S. binervosa* (G. E. Sm.), which is doubtfully referred to *S. occidentalis* by Boissier, I am enabled to state that they are undoubtedly the same plant, although no sterile branches are represented on the plate in 'Eng. Bot. Suppl.' As that name was published in 1830 it has the priority of the one here adopted, which dates only from 1844. The high authority deservedly awarded to the 'Prodromus,' which will doubtless cause the use of Mr. Lloyd's name universally on the continent, seems a sufficient reason for not attempting to replace it by one which we could scarcely, under the circumstances of the case, expect to be adopted out of Britain. I trust therefore that my friend Mr. Smith will excuse my not following his nomenclature in this case.

5. *S. caspica* (Willd.); foliis obovato-vel lanceolato-spathulatis in petiolum attenuatis, scapis a basi ramosissimis granulato-scabris, ramis inferioribus capillaceo-multifidis sterilibus: axillis acutangulis, spiculis 2-3-floris in spicas ad ramorum extremitatem confertas densissime congestis, calycis limbo 5-lobo denticulis intermediis nullis: lobis ovatis cuspidatis denticulatis.

S. caspica, Willd. *En. Berol.* i. 336; *Bieb. Fl. Tauro-Cauc.* iii. 253; *Bert. Fl. Ital.* iii. 530; *Reich. Iconog.* ii. t. 194; *DeCand. Prod.* xii. 660.

S. reticulata, *Bieb. Fl. Tauro-Cauc.* i. 250; *Sm. Eng. Bot.* t. 328; *Eng. Fl.* ii. 116. not *Linn.*

S. bellidifolia, *DeCand. Fl. Fr.* iii. 421.

S. dichotoma, *Duby, Bot. Gall.* i. 388. not *Cavan.*

Scape often simple for about an inch from its base, but after-

wards repeatedly forked with acute-angled axils. Outer bract almost wholly diaphanous, bluntly pointed; inner twice as long, blunt, upper half wholly diaphanous. Leaves short, variable in breadth and often rather acute, usually with a small mucro from below their extremity; the point sometimes so strongly recurved as to cause the leaf to appear retuse.

Muddy shores of Norfolk and Suffolk. Jersey, *Dr. Jos. Dickson.*

British botanists will doubtless complain that the name usually employed by them for this plant is here replaced by one nearly or altogether a stranger to them, and which certainly seems far from appropriate when applied to an English plant; but it may be remarked that the name *S. reticulata* has been attached to so many quite different species as to make its retention a source of confusion and difficulty rather than of use. The remark of Boissier seems very just when, after stating that the Linnæan plant is probably that now called *S. cancellata* (Bernh.), he adds, "hoc nomen cæterum multis plantis attributum omnino rejiciendum." The Linnæan specific character is short, but to my mind conclusive against our plant being his *S. reticulata*. His words are, "*S. scapo paniculato prostrato, ramis sterilibus retroflexis nudis, foliis cuneiformibus*" (Sp. Pl. 394); and it is curious to observe how Smith, when publishing the supposed *S. reticulata* in 'Eng. Bot.' (t. 328), slightly altered that character by the addition of the words "a little pointed" to the description of the leaves: in the 'Eng. Fl.' (ii. 116) he has omitted the term "ramis retroflexis" of Linnæus, but still says "leaves wedge-shaped" in the specific character, but alters it to "spathulate" in the description. Our plant certainly cannot be correctly described as having "ramis sterilibus retroflexis," for they are all ascending or even erect, forming very acute angles at their bifurcations; neither are its leaves at all "wedge-shaped," but may be correctly designated obovate-spathulate. The remark in 'Eng. Bot.,' that the "bark in our specimens is a little crisped and tuberculated, which we do not observe in the Linnæan ones," shows that Smith was not altogether satisfied of the identity of the plants.

Let us now turn to the *S. cancellata* (Bernh.), a specimen of which (the *S. furfuracea*, Reich. Fl. exsic.) is now before me, and we shall find the "ramis retroflexis" of Linnæus, or as Boissier says, "scapis ramosissimis rectangule-infracto-flexuosis," and also the "foliis cuneiformibus," or as he describes them, "obovato-cuneatis retusis."

Having I think disposed of the name *S. reticulata* as applicable to our plant, we now come to the proof of its identity with the *S. caspica* (Willd.), and here it may be remarked that Sir W.

J. Hooker (Br. Fl. ed. 5. 272) states that he is satisfied that "the *S. caspica* of Willdenow is the same as" the *S. reticulata* of Smith. I have now before me an extensive series of specimens of the European forms of *S. caspica*, viz. of the *S. dichotoma* of Duby, *S. bellidifolia* of DeCandolle, and *S. caspica* of Reichenbach. All of them are unquestionably the same species as our *S. reticulata* from Norfolk, indeed I do not find that they differ in any respect. In none of them are the leaves at all retuse, as seems sometimes to be the case with the Taurian plant described by Bieberstein, and originally called *S. reticulata* by him, but afterwards identified with the *S. caspica* of Willdenow, the Linnaean synonym being excluded. Can it be that the falsely retuse appearance occasionally put on by the leaves, as noticed in the above description of our plant, has deceived him?

Having now noticed all our known species of *Plumbaginaceæ*, I submit these remarks to the consideration of botanists, in the hope that they will be received with those allowances for their imperfect character which an attempt to elucidate so difficult a tribe of plants seems to require, and that they may lead to a more complete knowledge of this beautiful portion of our flora than we as yet possess.

St. John's College, Cambridge, Jan. 18, 1849.

XLV.—*Contributions to the Botany of South America.*

By JOHN MIERS, Esq., F.R.S., F.L.S.

[Continued from p. 269.]

SARACHA.

To this genus of the 'Flora Peruviana' I have to contribute several new species. In the Prodrômus of that work, p. 31, tab. 34, in order to illustrate the character of *Saracha*, its distinguished authors selected the plant which on a former occasion (Lond. Journ. Bot. 7. 353) I proposed to detach from that genus, because, as it differed essentially in structure and in habit from all the other species enumerated by them, it could not be regarded as its type. I preferred therefore to exclude that plant and retain the genus for the other several well-recognized and long-established species, as it would produce much confusion and answer no good purpose to make any change in their present arrangement. I now proceed accordingly to modify the generic character in the following manner, so as to include all the species below enumerated. Before doing this I will offer a few remarks in regard to the limits of this genus with respect to *Physalis*, *Witha-*

nia, *Capsicum*, &c. on the one hand, and *Witheringia* and *Brachistus* on the other. In all these instances there exists but little difference in the structure of the flower, the principal distinctive features being the inclosure of the berry in a greatly enlarged and ventricose calyx in *Physalis* and *Withania*, another structure of fruit in *Capsicum*, and a more fruticose habit and different inflorescence in *Witheringia* and *Brachistus*. In *Saracha* the inflorescence is axillary and umbellate, the number of radiating pedicels upon one single peduncle varying from 2 to 8: in *Physalis* the flowers are always solitary in each axil, upon a lengthened peduncle; and in *Witheringia*, as I have limited that genus (*ante*, p. 145), the flowers, though more numerous, are also upon simple peduncles: in this case however the inflorescence appears to be somewhat more complex, owing to several flowers growing out of each axil at successive periods, so that they are seen in various stages of development, from the nascent bud to the perfected fruit; but the true normal condition is that of a solitary pedunculated flower, as is frequently observed in the dichotomous axils, the other flowers commonly aggregated with it in many of the axils being in fact nothing more than a shortened and dwarf form of an axillary flowering branchlet, which is often seen in a more lengthened state of development. This is distinctly shown in the figure of *Witheringia*, plate 35, 'Illust. South Am. Plants.' In *Physalis* the corolla is generally campanulate, with an almost entire pentangular border, rarely 5-lobed; in *Witheringia* the tube is very short, the border patent and cleft nearly to the base into five equal oblong acute segments, while in *Saracha* the corolla is contracted at its base into a short tube, and suddenly spreads above into a border quite rotate, which is pentangular or half cleft into five lobes. In the latter genus the stamens are generally slender and distinct at their origin, being simply inserted at the base of the tube of the corolla; in *Witheringia*, *Capsicum*, and in several species of *Solanum*, they spring, as in *Hebecladus*, from as many triangular expansions, sometimes separated by small distinct intervals, at others almost or wholly united into an annular ring adnate to the tube a little above its base: in *Witheringia* these processes are most distinctly developed; in *Saracha* the same occurs in a greater or less degree, but they are generally more separated and completely free, arising from the marginal base of the tube; in *Physalis* these expansions are quite adnate with the tube. In *Saracha*, as in *Hebecladus*, the berry is supported by the persistent calyx, which although more or less expanding in size with the growth of the fruit always remains rotate, not vesicular and inclosing the berry as in *Physalis*, *Nicandra* and some other genera. In *Saracha*, as in these genera, and also as in *Witheringia*, the placentaë are fleshy and altogether

adnate with the dissepiment, but in *Brachistus* the placentæ are thin, membranaceous, and branching at right angles from the axile line of the dissepiment into the cavity of the cell, when they are free, furcated and ovuligerous. In *Saracha* and in *Physalis* the embryo is semicyclical, the radicle being double the length of the cotyledons; in *Capsicum* it is quite spiral and somewhat helical, the cotyledons being equal in length to the radicle; but the latter describes only a half-circuit of much larger radius, while the former makes fully a complete gyration of smaller diameter. In *Witheringia* the embryo is subannular, forming nearly $\frac{3}{4}$ ths of a circle by no means spiral, and the cotyledons are only $\frac{1}{4}$ th of its whole length. The following I conceive to be the limits of this genus:—

SARACHA, R. & P., char. emend.—*Calyx* brevis, submembranaceus, 5-angulatus, 5-dentatus, 5-nervosus, dentibus acutis brevibus, persistens. *Corolla* rotata, limbo sinuato, 5-angulato, sæpiissime 15-nervio, lobis s. angulis reflexis, æstivatione valde induplicato-valvata. *Stamina* 5, tubo corollæ prope marginem basalem affixa, ejusdem longitudine; *filamenta* filiformia, erecta, basi triangulariter dilatata; *antheræ* approximatae, oblongæ aut subrotundæ, basifixæ, 2-lobæ, lobis arcte connatis et longitudinaliter antice dehiscentibus. *Ovarium* ovatum, 2-loculare, placentis incrassatis septo adnatis, multiovulatis. *Stylus* simplex, longitudine staminum. *Stigma* capitato-bilobum. *Bacca* globosa, calyce membranaceo parum aucto suffulta. *Semina* plurima, in pulpam nidulantia, parva, reniformia: *testa* scrobiculata, hilo in sinu laterali: *embryo* intra albumen carnosum semicyclicus, teres, cotyledonibus uncinatis semiteretibus, radicula paulo inflexa infera hilo evitante dimidio brevioribus.—*Herbæ Americae intertropicae plerumque perennes, procumbentes, dichotome ramosæ, pilosæ; folia alterna vel gemina, integra, aut sinuato-dentata; inflorescentia umbellata, pedunculo 2–6-floro, axillari vel e dichotomiis sæpius orto.*

The following recorded species from the characters described appear to belong to this genus:—

1. *Saracha procumbens*, R. & P. Flor. Per. 2. 43. tab. 180 b.
2. ——— *umbellata*, DC. Jacq. Hort. Schoen. tab. 493.
3. ——— *contorta*, R. & P. l. c. tab. 180 a*.
4. ——— *jaltomata*, Schl. Linn. 13. Litt. 98; Linn. 19. 307.
5. ——— *Zuccagniana*, R. & Sch. Syst. 4. 687.
6. ——— *villosa*, G. Don, R. & Sch. Syst. 4. 684.
7. ——— *dentata*, R. & P. l. c. 2. 43. tab. 179 b.
8. ——— *biflora*, R. & P. l. c. 2. 42. tab. 179 a.

9. *Saracha viscosa*, Schrad. Sweet. Br. Fl. Gard. (2nd ser.) 4. tab. 323; Botanist, 4. tab. 168.

10. ——— *pubescens*, Willd. R. & Sch. Syst. 4. 687.

11. ——— *allogona*, Schl. Linn. 19. 308. *Solanum allogonum*, Bernh. Linn. 8. 252; Walp. Rep. 3. 48.

From this list are excluded *S. punctata*, R. & P., referred to *Pæcilochroma* (Lond. Journ. Bot. 7. p. 354), and *S. geniculata*, Mart. & Gall. Bull. Ac. Br. 12. 1. 133; Walp. 6. 575, which is evidently referable to *Physalis*, on account of its solitary pendulous flowers and yellow corolla with large purple spots. Galeotti's Mexican plant, no. 1226, is said by Schlechtendal (Linn. 19. 308) to be the *Saracha angulata*, Linn., which is clearly a typical error, instead of *Physalis angulata*, Linn. Among the doubtful or undescribed species of *Saracha* may also be mentioned as of no value for want of sufficient details, *S. brasiliensis*, Klotzsch, Linn. 14. 290; *S. micrantha*, DeC. Cat. Hort. Monsp. 1813; *S. peruviana*, D. Diet. Gärtnerlexicon, 8. 525.

The following new species are now to be added to this genus:

12. *Saracha ciliata* (n. sp.);—caule angulato, glabro, vel sparse aspero-pilosulo, dichotome ramoso; foliis geminis, oblongis, utrinque attenuatis, subglabris, aut leviter glanduloso-asperis, erosio-denticulatis, et ad marginem ciliatis, breviter petiolatis; pedunculo brevi, axillari, vel e dichotomiis orto, umbellatim 2-floro, pedicellis apice incrassatis, pilosis; calyce majusculo, 5-partito, fere glabro, in nervis piloso, laciniis acutis; corolla ampla, pallide lutea, rotata, angulato-5-loba, lobis acutis, glabra, sed in nervis 15 extus pilosa, staminibus corollæ dimidio brevioribus, glabris.—Peruvia, v. s. in herb. Hook. (in valle Limæ, Mathews, n. 834).

This plant in its habit much resembles *S. diffusa*, but it is different in the form of its leaves, and in its much larger pale yellow flowers, with comparatively short, glabrous stamens and large anthers. Its leaves are $1\frac{3}{4}$ inch long, $\frac{7}{8}$ inch broad, on a petiole $\frac{1}{4}$ inch long: the peduncle is 4 lines long, and its much thicker pedicels are of equal length: its broadly spread campanular calyx is half an inch long, cleft nearly half way into five equal acute segments: the corolla is probably the largest of the genus, measuring in diameter nearly 2 inches, with five deep acute lobes, the stamens being quite glabrous, erect, and 4 or 5 lines long.

13. *Saracha propinqua* (n. sp.);—herbacea, caule dichotome ramoso; glabro; foliis lanceolato-ellipticis, margine erosio-denticulatis, utrinque sparse glanduloso-asperis, petiolo gracili, pubescente; pedunculo elongato, gracili, umbellatim 2–6-floro, axillari vel e dichotomiis orto, vix pubescente, pedicellis longis, filiformibus; calyce rotato, lobis acutis; corolla cærulea, rotata,

angulato-5-loba, lobis acutis, staminibus erectis, elongatis, imo pilis mollibus patentibus dense hirsutis : bacca pisiformi, calyce rotato suffulta.—Peruvia, *v. in herb. Hook.* (Cuesto de Purru-chucho, *Mathews*, no. 774, *S. procumbens nominata*.)

This plant is certainly very distinct from the *S. procumbens* of the 'Flora Peruviana,' and does not appear to correspond with any recorded species. The leaves are 2 inches long and 1 inch wide, with its broadest part towards the base, which is suddenly attenuated into a somewhat fine petiole 4 lines in length. The slender peduncle almost glabrous, striated and shining, is about an inch long, bearing on its summit the very delicate pedicels, umbellately spreading, and $\frac{3}{4}$ inch in length : the calyx measures very nearly half an inch across, and the rotate corolla is 1 inch in diameter, the stamens being $\frac{3}{4}$ inch long, very slender, smooth at the summit, while the lower moiety is densely pilose with very spreading articulated dark-coloured hairs : the round berries are about 4 lines in diameter, supported on their spreading, scarcely enlarged calyx*.

14. *Saracha diffusa* (n. sp.) ;—herbacea, caule angulato, glabro, dichotome ramoso ; foliis ovatis vel ellipticis, versus apicem attenuatis, et saltem obtusiusculis, grosse sinuato-serratis, laciniis obtusis, margine eroso-denticulatis et ciliatis, basi subinæqualibus, in petiolum gracilem angustissime decurrentibus, submembranaceis, reticulato-venosis, vix glabris, vel utrinque præsertim in venis glanduloso-pilosis ; floribus in dichotomiis umbellatis, 4–6 floris, pedunculo elongato gracillimo, pedicellis filiformibus glabris ; calyce rotato, angulato, 5-dentato ; corolla rotata, 15-nervia, extus lanuginosa, margine 5-angulata, longe ciliata, staminibus erectis, corollæ dimidio brevioribus, glabris.—Peruvia, *v. in herb. Hook.* (Cuesta de Purru-chucho, *Mathews*, no. 775, *S. contorta noncupata*.)

This species clearly does not correspond with the *Saracha contorta* of the 'Flora Peruviana,' agreeing neither with its figure nor its description. The leaves, which are remarkable not only for their sinuose serrate border, but for their distinctly eroso-ciliate margins, are $2\frac{3}{4}$ inches long, $1\frac{1}{2}$ inch broad, with a petiole half an inch in length : the peduncle of the umbel is from $\frac{3}{4}$ to 1 inch or sometimes $2\frac{1}{2}$ inches, and the pedicels $\frac{3}{8}$ inch long : the very expanded flower measures 8 lines in diameter. The whole plant appears herbaceous and almost glabrous, and is said to flower in April.

15. *Saracha laxa* (n. sp.) ;—caule angulato-striato, subglabro vel

* A drawing of this species with generic details will be given in the 'Illustrations of South Amer. Plants,' plate 38.

parce puberulo, dichotome ramoso : foliis late ovatis, basi sub-obtusis, repente in petiolum attenuatis, utrinque squamosopilosis, pilis articulatis ; floribus umbellatis, pedunculo axillari, elongato, pedicellisque 2-6 tertio brevioribus, pilosis ; calyce acutilobo, hirsuto ; corolla rotata, angulato-5-loba, lobis acutis, utrinque glabra ; staminibus dimidio brevioribus ; bacca pisi-formi, calyce rotato aucto suffulta.—Mexico, *v. in herb. Hook.* (Oaxaca, *Galeotti*, no. 1169.)

The branches of this plant are straight and slender, the internodes being very distant ($4\frac{1}{2}$ inches apart) ; the leaves are $1\frac{3}{4}$ inch long and $1\frac{1}{4}$ inch broad, upon a petiole half an inch in length ; the peduncle is 2 inches long, slender, the pedicels being $\frac{3}{4}$ inch in length ; the calyx is cleft half way down, and is about 3 lines broad ; the corolla when spread measures nearly an inch in diameter.

16. *Saracha auriculata* (n. sp.) ;—caule angulato, dichotome flexuoso, glaberrimo, rubescente ; foliis geminatis, rhomboideolanceolatis, acuminatis, imo in petiolum cuneatis, infra medium acutato-auriculatis, et irregulariter grosse sinuato-dentatis, utrinque glabris, subtus nervis prominulis, margine subciliatis ; umbella sub-6-flora, pedicellis pedunculo axillari æquilongis, glabris, apice incrassatis ; corolla parvula, rotata, 5-angulata, lutea, glabra, margine ciliata ; staminibus corollæ æquilongis, imo hirsutulis ; bacca pisiformi, calyce subaucto rotato suffulta.—Nova Granada, *v. in herb. Hook.* (Plages de Combayma, *Goudot*.)

This species is very distinct, being entirely glabrous : its leaves are $3\frac{1}{4}$ inches long, 1 inch broad in the middle, and $1\frac{3}{4}$ inch across the very acute and somewhat auricular lobes, the petiole being $\frac{1}{2}$ inch in length ; the peduncle and pedicels are each $\frac{3}{4}$ inch long ; the calyx is 2 lines in length, becoming 6 lines in diameter in fruit ; the small yellow rotate corolla is only 5 lines in diameter, the stamens being 3 lines long ; the berry is globular, 3 to 4 lines in diameter.

17. *Saracha glabrata* (n. sp.) ;—caule stricto, glabro, angulato ; foliis geminis, oblongis, utrinque attenuatis et glaberrimis, submembranaceis, reticulato-venosis, obsolete denticulatis, nervo marginali ciliatis, petiolo caniculato glabro ; pedunculo axillari, 2-floro, pedicellisque æquilongis pubescentibus ; bacca pisiformi, calyce persistente rotato, reticulato, semi 5-fido, lobis triangularibus, margine nervisque ciliatis, suffulta.—Mexico, *v. in herb. Hook.* (*Dr. Coulter*, no. 1226.)

The leaves of this species are $1\frac{3}{4}$ inch long and $\frac{5}{8}$ inch broad, on a petiole $\frac{3}{8}$ inch in length. The peduncle is half an inch long,

the pedicels $\frac{5}{8}$ inch in length, and the calyx nearly half an inch in diameter.

18. *Saracha conspersa* (n. sp.) ;—caule dichotome ramoso, angulato-striato, pubescente ; foliis geminatis, oblongis, acuminatis, basi subobtusiusculis, repente attenuatis et in petiolum elongatum decurrentibus, utrinque molliter pubescentibus, nervis patentim pilosis, margine subrevoluto ciliatis ; floribus umbellatis, pedunculo axillari petiolo duplo longiore, pedicellis 4–6 dimidio brevioribus, patentim radiatis ; calycis laciniis lineari-acutis, patentim villosis ; corolla rotata, viridi-lutea, maculis plurimis viridibus ad medium notata, glabra, 5-angulata, angulis acutis, margine ciliata, staminibus glaberrimis, erectis, corollæ æquilongis.—Mexico, v. in herb. Hook. (Dr. Coulter, Zimapan, no. 1227.)

The leaves of this plant are $2\frac{3}{4}$ inches long, $1\frac{1}{4}$ inch broad, on a pilose slender petiole half an inch in length ; the peduncle is $1\frac{1}{8}$ inch, the pedicels $\frac{1}{2}$ to $\frac{5}{8}$ inch long, the calyx 2 lines, the corolla $\frac{3}{4}$ inch in diameter, and the stamens $\frac{1}{4}$ inch in length.

19. *Saracha acutifolia* (n. sp.) ;—caule angulato, fere glabro ; foliis lineari-lanceolatis, grosse inciso-serratis, apice acuminatissimis, imo in petiolum attenuatis, utrinque in nervis margineque sparse pilosis ; floribus axillaribus, foliis dimidio brevioribus, pedunculo gracili, sub 2-floro ; calyce acutilobo, hirsutulo ; corolla rotata, 5-angulata, lutea, glabra, margine ciliata, intus imo maculata et tomentosa, staminibus brevioribus, filamentis glabris, antheris iisque æquilongis.—California, v. in herb. Hook. (Dr. Coulter, no. 593.)

The specimen above noticed is not more than 4 inches in length, and is probably only a fragment, but the plant would seem to be very small in its growth : the leaves are $1\frac{1}{2}$ inch long, 5 lines wide in their broadest part, with about five deeply incised teeth on each side ; the petiole measures only $\frac{1}{4}$ inch, the hairs are very short and scabrid, and are seen chiefly on the nervures and margin ; the calyx is very short with acute lobes, about a line long ; the corolla across its mouth measures about $\frac{5}{8}$ inch in diameter, the filaments are 2 lines, the anthers $1\frac{1}{2}$ line, and the pistil 3 lines long : the peduncle and pedicels together measure about half an inch.

20. *Saracha vestita* (n. sp.) ;—caule fere suffruticoso, molliter tomentoso-hirtello ; foliis oblongis, apice attenuato-acuminatis, basi obtusiusculis, margine eroso-denticulatis, utrinque tomentosis, breviter petiolatis, petiolis pedunculisque pilis patentibus articulatis flavidis dense sericeis ; pedunculo axillari, sub-brevi, 2-floro ; calyce piloso, 5-dentato ; corolla rotata, 5-angulata,

extus margineque pubescente; staminibus pilosis; bacca pisi-formi, calyce subaucto rotato suffulta.—Columbia, v. in herb. Hook. (*Hartweg*, no. 1292.)

Judging from the specimen above referred to, this plant would appear to be almost erect, and different from the usually straggling dichotomous growth of this genus, but in the structure of the flower and of the seed it accords entirely with *Saracha*. The leaves are $1\frac{1}{2}$ inch long, $\frac{3}{4}$ inch broad, upon a very short petiole of 4 or 5 lines; the very sericeous peduncle with its two pedicels are scarcely longer than half an inch; the calyx in flower measures $\frac{3}{8}$ inch in diameter, increasing in fructification to a diameter of $\frac{5}{4}$ inch; the corolla barely measures $\frac{5}{4}$ inch across, and three parallel nervures extend from the apex of each segment to the base; the fruit is from 3 to 4 lines in diameter.

21. *Saracha glandulosa* (n. sp.);—glanduloso-pubescent; foliis alternis, floralibus subgeminis, oblongis, acuminatis, in petiolum longiusculum attenuatis, inæqualiter grosse serratis et eroso-denticulatis, crassis, utrinque tomentosis, nervis patentim pilosis, margine glanduloso-ciliatis, superioribus subintegris; pedunculo brevi, axillari, 2-floro, pedicellis æquilongo; calyce 5-fido; corolla parva, rotata, flava, utrinque subpubescente, angulato-5-loba, lobis acutis; staminibus inclusis, filamentis brevibus, imo dilatatis, pilosis, antheris ovalibus, conniventibus. —Nova Granada, v. in herb. Hook. (*La Peña*, *Bogota*, *Goudot*.)

This is the plant elsewhere mentioned as appearing to me to bear so close an analogy with the figure and character of *Witheringia solanacea* (L'Herit.). Its leaves are $2\frac{1}{4}$ inches long, 1 inch broad, on a somewhat slender petiole 9 lines to an inch in length: the peduncle and pedicels together scarcely measure more than 3 lines, the flower being no more than 4 lines in diameter; the stamens, scarcely a line long, are shorter than the somewhat campanular base of the corolla, the filaments are suddenly dilated into triangular processes at base, and united into a short adnate ring; above they are flat and narrow, the margins being clothed with diverging ciliate hairs; the anthers are oval, adnate to a small oblong dorsal connective, and they burst on the edges by longitudinal fissures*.

22. *Saracha solanacea*. *Witheringia solanacea*, L'Herit. *Stirp. Nov. Angl.* 1. 33. tab. 1; *Aiton*, *Hort. Kew.* 1. 149; *Lam. Illustr.* 1. 326. tab. 82; *Dict.* 8. 800;—radice tuberoso fusi-formi; caule inferne lignoso, perenni; ramulis subherbaceis, annuis, erectis, pedalis, pilosis, angulatis; foliis ovato-ob-

* This plant will be shown in plate 39 A. of the 'Illustr. South Amer. Plants.'

longis, v. ovato-lanceolatis, pilosulis, margine ciliatis, acutis, basi obtusis, petiolatis, superioribus floriferis geminis; floribus tetrameris, umbellatis, umbellis fere sessilibus, pedicellis divaricatis, petiolo unciali æquilongis, calyceque brevi 4-dentato glabris, corolla calyce 2-plo majore, tubo urceolato imo coarctato, tuberculis 4 instructo, limbo 4-lobo, rotato, lobis lanceolatis, staminibus 4, tuberculis alternis, filamentis brevibus, imo dilatatis, pilosis, antheris ovalibus, conniventibus.—America meridionalis.

This plant, known only as having been cultivated in the Botanic Garden of Kew, is described by L'Heritier and Aiton as above-quoted, but the dried specimens preserved by these botanists do not appear in the Banksian herbarium. The stem is said to be a foot high, covered with dark red pubescence; the leaves are 3 inches long, upon a petiole nearly an inch in length, and almost glabrous; the umbels are nearly as long as the petioles, the pedicels being scarcely half an inch long; the calyx is short and glabrous; the corolla of a pale yellow colour; the tube is $1\frac{1}{2}$ line in diameter, and the lobes 3 lines long. The fruit is a 2-locular berry, with numerous seeds attached to an adnate placenta projecting from each side of the dissepiment. The characters of this plant will thus be seen to be all strictly in accordance with the genus *Saracha*, as has been noticed on a previous occasion when treating of the genus *Witheringia* (*ante*, p. 143), and the reasoning upon which this conclusion is based will be found strengthened by a comparison of L'Heritier's figure of his *Witheringia solanacea* with that of the preceding species *S. glandulosa*, to which I have just made reference.

23. *Saracha diffusa* (n. sp.);—caule angulato-striato, dichotome diffuso, subglabro vel parce puberulo; foliis late ovatis, acutis, basi obtusiusculis, repente in petiolum attenuatis, superioribus geminatis, utrinque pilis articulatis pubescentibus; floribus umbellatis, pedicellis 2–6, pedunculo elongato folio æquilongo tertio brevioribus, omnibus pilosis; calyce acutilobo, hirsuto; corolla rotata, angulato-5-loba, utrinque glabra, staminibus corollæ dimidio brevioribus; bacca pisiformi, calyce rotato aucto suffulta.—Mexico, v. in *herb. Hook.* (Oaxaca, Galeotti, no. 1169.)

In this plant the internodes are very distant, and the leaves, shorter than the peduncle, are $1\frac{1}{2}$ inch long by $1\frac{1}{4}$ inch broad, upon a petiole of 5 lines in length; the peduncle is 2 to $2\frac{1}{2}$ inches long, the pedicels $\frac{3}{4}$ inch in length.

XLVI.—On the *Animal of Kellia rubra*.

By W. CLARK, Esq.

To the Editors of the Annals of Natural History.

GENTLEMEN,

Norfolk Crescent, Bath, May 5, 1849.

I BEG you to allow me the insertion of a few observations, in reply to Mr. Alder's last paper on *Kellia rubra* in the May number of the 'Annals.'

That gentleman has stated the result of his re-examination of the animal of *Kellia rubra* with great candour, observing that "in all cases" I have described "the parts very correctly." I feel pleasure in the corroboration of my examination of this very minute bivalve by so competent an observer, though we differ as to their uses. But however far apart our opinions may be, we will not forget in our disputations the prayer of the nymph Arethusa,—

"Doris amara suam non intermisceat undam."

I do not think it will be difficult to show that the anterior tube-like fold of the mantle of *Kellia rubra* is not a special branchial organ, according to Mr. Alder's views, and which he still retains.

It must be borne in mind that the mantle of *Kellia rubra* is open from the posterior branchial slit to its anterior termination. The open fold in question is merely a prolongation of that membrane; and when the animal opens its valves, it must receive, like the *Mactra* and *Veneres*, or any other bivalve with an open mantle, the currents of sea-water; and in closing them, a great part thereof, after bathing the branchiæ, is ejected from the aperture of *ingress*, and only a portion of it passes out by the posterior orifices.

These remarks will show that I did not use the words "branchial and anal, as applied to these apertures, in a literal and restricted sense." I am not aware I have said anything to warrant this inference. Mr. Alder has misunderstood me. I only stated that the posterior branchial slit in *Kellia rubra* is both a receiver and expeller of water; and this view I firmly adhere to. I never intended to state it was the only one, when the contrary fact is so evident in *Kellia rubra*.

Mr. Alder observes, that, agreeably to the "known œconomy of the bivalves, the inhalant is always kept distinct from the exhalant current, and admitted by a separate aperture from that by which the latter is expelled." This position is, I think, incorrect; as in those bivalves with open mantles the currents of water enter by the great pedal orifice or *rima magna* of the mantle, to aërate the branchiæ, and the greater part of the im-

pure fluid is expelled by the aperture of *ingress*, a small portion, as before stated, passing out by the posterior siphonal apparatus. In this case the apertures of *ingress* and *egress* are not "kept distinct."

In those mollusca with nearly closed mantles only a small portion of fluid can enter by the restricted pedal orifices; the far greater part must be inhaled by the posterior siphons, and is often expelled simultaneously at both orifices, as I have observed in *Pholadidea papyracea*, the most closed of all the bivalves; and whether the water be received through the anal or branchial tube, or both, the fact of the simultaneous expulsion of the fluid in almost equal streams proves that the known branchial œconomy of the bivalves does not require the apertures of inhalation and exhalation "to be kept distinct," as it is clear that water is expelled by one at least of the tubes of *ingress*.

The doctrine of the known œconomy of the bivalves, requiring the apertures of *ingress* and *egress* to be kept distinct, cannot, I think, be admitted; it has not been verified by competent authority. I do not believe in it, as it is disproved by indisputable facts.

I have little doubt that the water required for buccal and branchial uses, in the mollusca with closed mantles, is received through both the posterior apertures, anal and branchial as they are called; and probably at their bases there is an internal communication, thus allowing the water from both to pass into the great cavity of the branchiæ, to bathe them, and for sustentation of the animal; and after these functions are fulfilled, it is in like manner expelled from both orifices, and often simultaneously, as may be seen in any of the *Pholades*, *Lutrariæ*, or *Myæ*.

The water, I believe, never makes a circuit, or enters the legitimate anal tube, or issues therefrom, and which, to prevent confusion, ought to be denominated the rectum, or that portion of the viscera proceeding from the stomach to its termination at the posterior end of the body, where it empties itself into a conduit termed the anal tube. The legitimate anal cylinder, or rectum, is only for the discharge of the rejectamenta of the aliment entering the buccal orifice, and from thence passing to the stomach; for if the water entered this duct, either postœally or anteally, in the one case it would force back the fæces into the stomach, and in the other none would ever be found in the rectum; but the scalpel shows it is always filled from its point of junction with the stomach to its terminus with a cylindrical compact mass of fæcal matters, which, as the animal requires, is discharged by minute portions into the anal conduit; the water therefore for the branchiæ and sustentation must pass into the great branchial cavity, and issue therefrom by both the ducts at

which it entered, which is effected by the internal communication before mentioned between the two at their bases, the stream flowing smoothly out of the branchial one, and from the anal conduit, more or less irregularly as the animal opens or closes the hyaline valve, usually, if not always, found at its terminus.

A careful investigation of cause and effect, in these mollusca so difficult of examination, often produces a more satisfactory elucidation of facts than even the demonstrations resulting from the scalpel, which are often deceptive, erroneous and conflicting.

For these reasons the doctrine of the apertures of inhalation and exhalation being "kept distinct," or, in other words, that when the water is received by one duct it is discharged by another, is, I think, untenable.

Mr. Alder says, he saw, under the power of the microscope, a continuous current of water flowing into the anterior tube of *Kellia rubra*; all must admit this fact: as the fold is part of the open mantle, no microscope is here required, as in every open-mantled bivalve of adequate size this action is instantly made apparent by a common lens, and is the invariable result of the animal opening its valves; but that the most accomplished observer by the microscope can, with any certainty, detect in so minute a branchial slit as that of *Kellia rubra*, the entrance or egress of branchial currents, is to me a matter of the gravest difficulty, which I can only get over, not by doubting the perfect integrity of Mr. Alder's statement, but by supposing he may possibly be in error, and has been misled by the aberration and well-known great deceptions involved in the use of high microscopic powers.

But, for argument, we will assume that the posterior branchial slit, as Mr. Alder states, showed no signs of an ingress current. The contrary fact is, I think, proved by the contraction and dilatation of the slit; which action Mr. Alder admits, but says that it has "no power to produce the internal circulation, but merely to regulate the discharge." Surely the more reasonable assumption is, that the periodic opening and closing of the aperture is for the ingress and egress of part of the water for branchial uses; especially as I have shown that the analogous tubes of the close-mantled mollusca,—the anal one having, I believe, always at its terminus a hyaline contractile and expansive valve, which appendage the branchial one is sometimes provided with,—must of necessity receive and discharge the fluid necessary for the branchial œconomy.

As another, and the last proof I shall adduce, that the branchial slit, or aperture, in *Kellia rubra*, is not only for egress, agreeably to Mr. Alder's opinion, but is also one of ingress, according to mine, may be thus shown. Suppose *Kellia rubra*,

instead of being an open-mantled animal, is one of the closed mollusca,—where, in this case, is the entrance for the branchial currents? The only answer that can be given is, at the *posterior branchial slit*, and the discharge of the water must be at the *same aperture*. In this bivalve the fæces are, as I have repeatedly seen, discharged from the rectum in minute pellets into the *branchial slit*, which in this animal undoubtedly performs three functions, those of ingress and egress of branchial currents, and a conduit for the fæces.

It may be asked, why has nature departed from her usual branchial scheme only in *Kellia rubra* and *K. suborbicularis*? We will now examine into the "*cui bono*" of this fold of the mantle, considered as a branchial appendage. It is well known that nature never acts by way of surplusage; and having given *Kellia rubra* an open mantle by which the currents can enter, as in other analogous open bivalves, we must conclude she has not departed from her usual scheme, and that this fold is not a special branchial organ, but is intended to fulfill other functions.

I will mention what perhaps may be considered a conclusive proof that the tube-like fold of the mantle cannot be intended for the ingress of branchial currents, which is, that the animal very often thrusts its foot into the fold, and by the withdrawal of which it is opened and the edges separated. How then can a fold, whose form by this action is continually changing, and is subject to momentary interruption, be the conduit of regular, delicate, and uninterrupted branchial currents?

May we not infer from this constant alliance of the foot with the fold, that there is a more intimate functional connexion between them, perhaps of a locomotive nature?

I will now very shortly state the grounds of my conjecture, that the fold in question is to aid the animal in locomotion.

The habitat of this singular creature is at a far greater elevation in the littoral zone than any other bivalve, and nearly as far removed from the level of the water as the *Littorina petraea*, which is at no time completely submerged in the sea. The *Kellia rubra* on the Devon coast near Exmouth is generally imbedded in the *Lichina pygmæa*, which grows in the cavities of rocks of such considerable elevation and so near the land, that thousands of these animals pass their entire existence without perhaps ever being completely in a condition to receive branchial currents of sea-water; even the spray rarely reaches them except in gales of wind. It appears then that the tides washing the bases of their rocky habitat, combined with the saline mixture of atmospheric particles, supply a sufficient humidity for the growth of the *Lichina pygmæa* and the sustentation and welfare of the bivalve

colonies. These are startling facts, and go far to disprove Mr. Alder's doctrine, that the tube-like fold of the mantle is for the entry and regulation of branchial currents, which, even if they occasionally occur from spring tides and other causes, can only be in action for a very short time during the twenty-four hours. But I believe that in certain localities these creatures are not immersed in the sea-water for months together during the calms of summer. Many individuals of course inhabit lower levels, and will be more or less submerged.

Kellia rubra, then, may almost be considered a terrestrial bivalve. When it detaches itself from its hyaline delicate filamentary byssus, as it frequently does, to change place, food, and remove into more humid quarters, it is unable by its long slender foot to drag itself over the interstices of the fuci and the asperities or other matters in which it may happen to be settled without the aid of an additional power, which I am inclined to think is furnished by the extended fold of the mantle; and this supposition appears to receive strong support by the isochronal action of the foot and fold.

I am, Gentlemen, your most obedient servant,
WILLIAM CLARK.

XLVII.—*An Account of a Specimen of the Vaagmaer, or Vogmarus Islandicus (Trachypterus Bogmarus of Cuvier and Valenciennes), thrown ashore in the Firth of Forth.* By JOHN REID, M.D., Professor of Anatomy and Medicine in the University of St. Andrews.

[With a Plate.]

THIS fish was sent me on the 7th of April 1848 by Dr. John Berwick of Elie, near which place it was cast ashore dead. It was perfectly fresh when I received it; but the dorsal and caudal fins were damaged, and the ventral fins were entirely wanting—a condition, which, from the brittleness of these parts, is generally found in the adults of this genus of fishes*. Its characters showed distinctly that it belonged to the family Tænioides and genus *Trachypterus* of Cuvier and Valenciennes, and on comparing these with the descriptions of the species of *Trachypterus* given in the work of Cuvier and Valenciennes, and that of the *Trachypterus vogmarus* or *bogmarus* by Professor John Reinhardt of Copenhagen, contained in the Supplement to the 1st edition,

* Histoire naturelle des Poissons, par Cuvier et Valenciennes, tome x. pp. 314–15, and pp. 325–26. Paris, 1835.

and in the 1st volume of the 2nd edition of Yarrell's excellent 'History of British Fishes,' it was evident that it belonged to the latter species.

No unquestionably genuine specimen of this rare fish has, as far as I am aware, been hitherto found in the British seas; for the description and figure of the fishes thrown ashore in Orkney, supposed to be specimens of the deal-fish or Vaagmaer, given by Dr. Fleming* on the authority of Dr. Duguid, differ in so many important points from the Vaagmaer as must excite doubts as to their identity. Dr. Fleming is also disposed to regard as a specimen of the Vaagmaer one of the two fishes thrown ashore in the Moray Firth, and described by Mr. Hoy† as belonging to the *Trichiurus lepturus* of Linnæus, but the identity is here still more doubtful.

Its fins were of a light red colour, and the surface of the body and of the skull was of a bright leaden silvery lustre. The iris had also a silvery lustre. The greater part of the substance imparting the silver colour to the surface had been detached from one side of the body from the manner in which it had been packed up in transmitting it to St. Andrews; and though some parts of the surface of the other side had a duller lustre than others, from a cause which I shall afterwards explain, yet none was sufficiently dark or distinctly defined to constitute a dark spot similar to the two represented on each side of Reinhardt's specimen.

Its measurements were as follows:—

	ft.	in.
Length of body from point of nose to termination of the vertebral column	5	4
Height of body immediately behind the gills (not including dorsal fin)	0	8
Height of body 17 inches from point of nose	0	11
Height of body opposite vent.....	0	10 $\frac{7}{10}$
Height of body 40 inches from point of nose	0	10
The height of the body tapered gradually from this last part mentioned to 7 inches from the termination of the vertebral column, where it began to diminish rapidly.		
Height of body 7 inches from end of vertebral column	0	3
Height of body 4 inches from end of vertebral column.....	0	1 $\frac{2}{10}$
Height of head measured across the middle of the eyeball	0	6
Length of head (the upper jaw being fully protruded).....	0	8
The circumference of the eyeball circular, and its diameter measuring	0	2 $\frac{3}{10}$
Distance of vent from point of nose	2	9

The body and head were much compressed laterally, so that the whole animal was ribbon-shaped, the thickness of the upper edge being only $\frac{2}{12}$ ths of an inch, that of the lower edge being

* The Magazine of Natural History by J. C. Loudon, vol. iv. p. 215, 1831.

† Linnæan Transactions, vol. xi. p. 210.

$\frac{5}{24}$ ths of an inch, and the thickest part of the body where the viscera were placed measured only about 1 inch. The thickness of the most muscular part of the body immediately behind the gills and a little above the vertebral column, measured somewhat more than an inch.

In this, as in the specimen of *Trachypterus vogmarus* described by Professor Reinhardt, the height of the sword-blade-shaped body was the same or nearly the same for more than one half of its length; while in the specimens of *Trachypterus falx* and *T. iris* described by Valenciennes, the greatest height of the body was at or near the occiput, from which it gradually tapered towards the tail.

The lateral line of the body at its commencement immediately behind the operculum was nearer the upper than the lower edge of the body, but it began immediately to descend, and continued its course backwards to the tail, running nearer the lower than the upper edge. The lateral line immediately behind the gills, where the height of the body was 8 inches, was placed $3\frac{1}{2}$ inches from the upper edge; and where the height of the body was 11 inches, it was $4\frac{1}{2}$ inches from the lower edge.

It was not easy to reckon exactly the number of the dorsal rays, but I counted 176. The length of the longest dorsal ray was $4\frac{1}{2}$ inches. Only six rays were left in the caudal fin, and the longest of these was $8\frac{1}{2}$ inches. There were ten rays in each pectoral fin, and seven of these were considerably longer than the other three. The longest were from the second to the seventh, reckoning from before backwards. The length of the pectoral fin was $2\frac{1}{4}$ inches and nearly 1 inch in breadth.

A number of small cartilaginous tubercles presenting the appearance of warts was placed along its lower edge, and extended upwards from that edge $\frac{4}{12}$ ths of an inch. The largest of these were about $\frac{3}{24}$ ths of an inch in breadth, and less than $\frac{1}{12}$ th of an inch in height. They became perceptibly smaller about 8 inches from the end of the spinal column, and in the last 3 inches of the lower edge were altogether absent. They were composed, as ascertained by the microscope, of true cartilage. They were implanted on a very strong band composed of dense fibrous tissue stretching along the whole lower edge of the body. Along the line of junction of the cartilaginous and fibrous tissues, there was a thin layer of fibro-cartilage. From the upper edge of this fibrous band a fibrous lamina ran upwards and became continuous with the fibrous lining membrane of the cavity of the abdomen, and behind the abdomen it extended upwards along the mesial plane of the body to the vertebral column. The lateral line is formed, as was ascertained by microscopic examination, by a longitudinal band of a peculiar tissue to be afterwards described, which follows the

course of the bodies of the vertebræ, and runs parallel to the mesial line of the bodies of the vertebræ in that part of the body of the animal occupied by the anterior caudal vertebræ, but on proceeding backwards it tends a little downwards, so that for the last 9 or 10 inches of its course it lies immediately below the lower edge of the bodies of the last caudal vertebræ, and at its termination meets its fellow of the opposite side at the lower edge of the body. Opposite each vertebra this tissue is thickened, forming a series of small, irregular-shaped, slight elevations lying in the course of the lateral line, from the centre of each of which in the neighbourhood of the tail, but there only, there projected a small, hard, sharp spine curved forwards. Many of these elevations have a puckered or stellated appearance. When the colouring matter on the surface is rubbed off, the small tubercles on the surface of the chorion or true skin are brought more distinctly into view. These tubercles are small and placed near to each other. From nine to fifteen of them may be counted lying in, or nearly in, the same line in a space of an inch in length. They vary from $\frac{3}{4}$ ths to $\frac{1}{4}$ th of an inch in length in their longest diameters, and are very slightly elevated above the surface of the chorion. The largest are about $\frac{3}{4}$ ths of an inch in length, and $\frac{2}{4}$ ths in breadth. The larger are placed in parallel rows, a double row running in the course and nearly through the whole length of each interneural spine*, beginning at the upper edge of the body, and terminating opposite the part where the interneural spines dip downwards between the upper extremities of the spinous processes of the vertebræ to be united to them by fibrous tissue. The smaller and much more numerous tubercles are about one half the size of the largest, are scattered irregularly in the intervals of the double rows and over the rest of the surface of the body. These tubercles differ in their intimate structure from those more prominent ones arranged along the lower edge in the manner to be afterwards described.

As the varied relative heights, at different parts of the body, of the space between the lateral line and the lower margin of the body, that between the lateral line and the upper extremities of the spinous processes of the vertebræ, and of that between the upper extremities of the spinous processes of the vertebræ and the upper margin of the body or that occupied by that portion of the interneural spines placed above the upper extremities of

* The term *interneural spines* applied by Professor Owen to the inter-spinous bones is used here, for the structure referred to is not in this fish composed of osseous tissue as in the osseous fishes, but of cartilaginous and a peculiar tissue, and is in all respects so unlike bone, that I feel a great reluctance to give them the name of bones. No doubt the term 'spine' is not an appropriate one either, but it is less incongruous than that of 'bone.'

the spinous processes, can be ascertained by external examination when the colouring matter of the skin has been rubbed off, and may be useful in identifying the species, I have subjoined a few such measurements. Immediately behind the occiput the spinous processes are decidedly longer than the interneural spines.

	From lateral line to lower margin of body. In inches.	From lateral line to points of spi- nous processes.	From points of spinous pro- cess to upper margin of body.
Five inches behind occiput (measured along lateral line)	$4\frac{4}{10}$	3	$2\frac{1}{10}$
Ten inches behind occiput	$4\frac{5}{10}$	3	3
Midway between vent and occiput ...	$4\frac{7}{10}$	$2\frac{2}{10}$	$4\frac{1}{10}$
Opposite vent	$4\frac{7}{10}$	2	$4\frac{1}{10}$
Midway between vent and termination of caudal vertebræ.....	$2\frac{1}{10}$	$1\frac{2}{10}$	$2\frac{8}{10}$
Nine inches from termination of cau- dal vertebræ	$1\frac{6}{10}$	$0\frac{9}{10}$	$1\frac{2}{10}$

The great length of the interneural spines causes the spinal column to be placed nearer the inferior than the superior edge of the body through the greater part of its length.

In the intermaxillary bones of the upper jaw there were seven small, conical, curved and reclined teeth, the apices of which projected backwards, situated about $\frac{7}{12}$ ths of an inch from the anterior margin of the jaw. In the lower jaw there were four teeth on the right side and two on the left, placed near the anterior margin of the jaw. Three of these on the right side were in a row, while the fourth, which was smaller, was placed between them and the anterior margin of the jaw. There were appearances of a tooth having lately been displaced from the left side of the lower jaw. The largest of these teeth measured $\frac{3}{4}$ ths of an inch along their convex edge, while their apices were only elevated $\frac{1}{24}$ th of an inch above the mucous membrane of the mouth. There were two teeth on the anterior part of the vomer, one considerably smaller than the other, and immediately in front of the larger, placed in the mesial line of the head, nearly of the same size as those in the jaws, also curved backwards, but more erect than those in the jaws. The outer edges of the two superior pharyngeal bones were also provided with curved sharp-pointed teeth, the apices of which looked inwards towards their fellows of the opposite side. These were longer, more erect, and not so thick at their base as those of the jaws. Two rows of processes—from six to twelve in number in each row—arranged along the convex edge of each branchial arch, one row springing directly from that edge, the other formed of smaller processes, placed immediately below this and springing from the upper part of the posterior surface of the arch, were furnished with small, sharp-pointed, slightly curved teeth. No teeth were observed in any other situation than those named above, viz. the intermax-

illary bone, the lower jaw, the vomer, the superior pharyngeal bones, and the processes of the branchial arches*.

Abdomen.—On opening the abdomen the digestive tube presented the appearance of being nearly straight throughout its whole length, but on proceeding with the dissection it was found that a loop of intestine about 20 inches in length was overlapped by a mass of cæca (pyloric cæca), which extended between 9 and 10 inches along the lower edge of the stomach and œsophagus, and was tied closely to these by folds of peritoneum, except at its anterior portion. This mass of cæca measured about $\frac{8}{12}$ ths of an inch in height and $\frac{7}{12}$ ths of an inch in breadth at its thickest part. On tracing the digestive tube onwards from the back part of the mouth in a straight course for about 13 inches we arrived at the pyloric portion of the stomach (Pl. XVI. fig. 1 *a*) projecting from its lower edge, forming a process or diverticulum about $\frac{7}{12}$ ths of an inch in height and the same in length; and was overlapped and hid from view by the posterior extremity of the mass of cæca. The stomach was prolonged backwards beyond the pyloric portion for $2\frac{1}{2}$ inches, gradually becoming narrower, terminating in a point, and forming a *cul de sac* (fig. 1 *b*). The breadth of this first portion of the digestive tube, measured before it was opened, was about $\frac{10}{12}$ ths of an inch at the anterior part and $\frac{8}{12}$ ths of an inch immediately above the pyloric portion of the stomach.

At its commencement at the back part of the mouth it was narrow and only admitted the passage of the little finger, but immediately below this it became wider and measured 2 inches across when slit open. It very gradually became narrower as it proceeded backwards, and immediately above the pyloric portion of the stomach it measured $1\frac{1}{2}$ inch across. There was however no distinctly defined dilated portion at the anterior part to which the name of pharynx could be given, and there was no distinct line of demarcation between the œsophagus and stomach. The walls of the stomach and œsophagus were of the same thickness, with the exception of a slight thickening of the pyloric portion, and there was no marked difference in the appearance of the mucous membrane, to the unaided eye, in these parts. The mucous membrane was thrown into nine longitudinal folds, part of which were continued into the pyloric, and the rest into the *cul de sac* of the stomach. These longitudinal folds were very prominent in the narrow commencement of the digestive tube,

* I think it right to state, that after I had examined the external characters of this animal, circumstances prevented me from proceeding with its dissection for several months, and it was preserved during that time in a solution of bay-salt, alum, and corrosive sublimate (Goadby's solution). Several representations of it were taken by the calotype process, soon after it came into my possession, by Dr. John Adamson.

and the mucous membrane there presented numerous prominent villi. The pyloric portion of the stomach was curved, the convexity looking backwards and the concavity forwards; it contracted gradually and terminated by opening through a narrow orifice (pyloric orifice), which projected into the commencement of the duodenum. The duodenum (fig. 1 *l*) or first portion of the small intestine ran forwards along the lower edge of the œsophagus for 9 inches, having its external surface closely surrounded by numerous aggregated cæca (fig. 1 *d*). These cæca were each about an inch in length, their shut extremities directed backwards and their open mouths forwards, were longer at the commencement of the duodenum than at its termination, and opened by numerous orifices arranged in no regular order upon the inner surface of the duodenum* (fig. 1 *l*). The duodenum became narrower at its termination. At its commencement its circumference, as ascertained by measuring it across when slit open, was $\frac{1}{12}$ ths of an inch, at its middle $1\frac{1}{4}$ inch, and at its termination $\frac{5}{12}$ ths of an inch. The portion of the small intestine (fig. 1 *c*) in which the duodenum terminated ran forwards for about an inch in the same line with the duodenum, then turned suddenly upon itself, and proceeded backwards along the lower edge of the mass formed by the cæca; and immediately beyond the posterior extremity of the cæca it terminated in the large intestine by a narrow round orifice formed by a funnel-shaped projection of the mucous membrane of the small intestine downwards into the commencement of the large intestine (fig. 1 *h*). The large intestine (fig. 1 *m*) proceeded straight backwards until it had arrived nearly opposite the vent, when it bent downwards to reach the anal orifice. The walls of the stomach and œsophagus were considerably thicker than those of that portion of the digestive tube placed below the termination of the duodenum, and measured about $\frac{1}{12}$ th of an inch. The walls of the duodenum were thinner than those of the œsophagus, but thicker than those of the portion of the digestive tube beyond it. The inner surface of the mucous membrane of the small intestine presented a slight reticulated appearance, while that of the large intestine was thrown into numerous short and small longitudinal folds. The stomach and intestines were nearly empty, containing only a small quantity of slimy matter.

The spleen (fig. 1 *o*) was very small and round in form, was placed between the stomach and the terminating part of the small intestine, and was overlapped by the posterior cæca.

The liver extended across the lower surface of the anterior por-

* Valenciennes, in his account of the *Trachypterus leiopterus*, describes the cæca opening into the duodenum in that animal "presque sur deux rangées parallèles et opposées."

tion of the œsophagus for $2\frac{1}{2}$ inches, and stretched backwards for other 3 inches along the left side of that tube, so that on the left side it measured $5\frac{1}{2}$ inches. The gall-bladder was large.

The kidneys were 14 inches in length, were not lobulated, were much larger at their anterior extremity, and narrow and cord-like at their middle and lower parts. Their anterior extremity was placed close to the base of the cranium, and was compressed laterally and elongated from above downwards. Their middle and lower portions were inclosed in a canal formed by the transverse processes of the vertebræ and the dense fibrous membrane connecting these processes together, and the two kidneys were only separated from each other by a thin membranous partition. The ureters entered the cavity of the abdomen, about 2 inches below the lower end of the kidneys, by perforating the aponeurotic membrane which separates the kidneys from the cavity of the abdomen; they then continued their course backwards, having been united to form a single tube, along the upper surface of the abdomen, tied closely down to the aponeurotic membrane lining the abdomen. This tube, about $2\frac{1}{2}$ inches before its termination on the external surface of the body, became suddenly dilated to between twice and three times its former calibre, and this continued for 1 inch of its course, forming a small urinary bladder. The urinary tube terminated in an opening immediately behind the anal orifice.

The ovaries measured 15 inches in length, were flattened, and their greatest breadth was $\frac{9}{12}$ ths of an inch, and their average breadth about $\frac{6}{12}$ ths of an inch. At first sight there appeared to be only one ovary, but on closer examination it was found to consist of two plicated bands of a light yellow colour—each constituting an ovarium—occupying the edges, while the central part was formed only of the fold of peritoneum inclosing them. The ova were all in a very early stage of their development. The ovaries in the posterior part of their course were closely united to the ureter. As they were broken across accidentally at the lower part, I did not succeed in tracing the oviduct; but finding a duct joining itself to the urinary canal near its termination, I thought it probable that this was the termination of the oviduct. No air-bladder was present.

Vertebral Column.—The vertebral column was destitute of osseous texture, and contained 97 vertebræ—38 abdominal and 59 caudal—each of which was hollowed out before and behind into a cup-shaped cavity. Their lateral external surfaces presented, in general, each five longitudinal slightly elevated ridges, and the articulating edges of the cup-shaped cavities were a little more prominent than the middle part of the vertebra. In the bodies of the caudal vertebræ a prominent longitudinal ridge oc-

cupied the centre of each lateral surface. The bodies of the vertebræ were subcylindrical, and a transverse section of the body of a dorsal vertebra (fig. 3) approached an oval form, was slightly longer in its vertical than in its transverse diameter, and was considerably wider across the centre than at the upper and lower edges, where its processes were attached.

The last caudal vertebra was short and terminated in, or at least was continuous with, a vertical plate of true cartilage, as proved by microscopic examination, which was thickened along its upper edge*. Along this thickened edge the caudal fins were articulated. The superior spinous processes were in general very slender, most of them almost thread-like, and were united together by a strong dense fibrous-looking membrane (fig. 3 *a*) continuous with the laminæ or neural arches forming the spinal canal. This strong fibrous membrane was prolonged upwards along the whole length of the spinous processes and also enveloped the lower extremities of the interspinous or interneural spines. These interneural spines were very flexible, appeared to be of a cartilaginous texture, to the unaided eye, at the upper part, and of a fibrous structure at the lower part. The upper extremity of each became considerably expanded, chiefly from before backwards; divided itself into two limbs having a notch between them; and one of these limbs projected backwards, the other forwards, the former uniting itself to the anterior limb of the corresponding expansion of the interneural spine immediately behind, the latter to the posterior limb of the corresponding expansion of the interneural spine immediately in front; the whole together forming a band of true cartilage, as ascertained by the microscope, running along the whole length of the spine, and affording articular surfaces for the rays of the dorsal fin. The rays of the dorsal and the interspinous or interneural spines are articulated in this manner. On the upper surface of those parts of this cartilaginous band formed by the junction of the two limbs into which the interneural spines divide, there is a shallow articular excavation, elongated from before backwards. Into this depression is fitted a cartilaginous disc secured by ligamentous fibres in such a manner that it is permitted to move slightly in all directions. The lower end of the ray of the dorsal fin bifurcates, and embracing this cartilaginous disc is firmly attached to its lateral surfaces. The mode of articulation between the fin-rays and the interneural spines here described, is similar to that between the fin-rays and the interneural and the inferior inter-

* This plate of cartilage ought, from its structure and relative position, to be regarded as formed by interneural spines. The rays of the caudal fin were placed close to each other at their articulation to the upper edge of this plate, but diverged as they proceeded outwards like the rays of a fan.

spinal or interhæmal spines in the turbot (*Rhombus maximus*) and in the genus *Platessa*, and probably in all of the *Pleuronectidæ*. The tendons of two small muscular bundles, which run parallel to each interspinous or interneural spine, are attached on each side to the bifurcated extremity of the fin-ray embracing the cartilaginous disc. Between these two muscles a thin aponeurotic prolongation is sent inwards from the spine. At the anterior part of the body the interneural spines and the spinous processes of the vertebræ are equal in number, but towards the posterior part of the body where the vertebræ become considerably longer, more than one interneural spine is interposed between two spinous processes. The vertebræ varied in length and in their other dimensions in different parts of the spinal column. The first and second—counting from before backwards—were considerably shorter than those which immediately succeeded them. The longest were placed in the posterior part of the spinal column. The following measurements point out the relative length, and some of the other dimensions of these vertebræ:—

Number.	Length in inches.	Height.	Breadth.
1	$\frac{5}{24}$	$\frac{12}{24}$	Nearly the same as the height.
2	$\frac{4}{24}$	$\frac{12}{24}$	
3	$\frac{6}{24}$		
4	$\frac{7}{24}$		
5	$\frac{8}{24}$		
58	$\frac{10}{24}$		
59	$\frac{5}{24}$		
60	$\frac{7}{24}$		
61	$\frac{12}{24}$		
86	1	$\frac{6}{24}$	$\frac{6}{24}$
87	1		
92	$\frac{8}{12}$		
95	$\frac{7}{12}$ *		

The transverse processes of the dorsal vertebræ were directed

* It is exceedingly improbable that this marked shortening of the bodies of the fifty-ninth and sixtieth vertebræ is their natural conformation, as they were nearly ankylosed by portions of cartilage which took the place of the gelatinous-looking substance occupying these cavities in the other vertebræ, and the cavities themselves were considerably diminished in depth. Valenciennes says that in the *Trachypterus leiopterus* the number of the vertebræ is ninety or ninety-one “qui ont cela de remarquable, qu’elles vont toujours en s’allongeant, et même en s’amincissant, ce qui rend les premières plus hautes que longues; vers le milieu elles commencent à devenir un peu plus longues que hautes, et la longueur de celles de l’extrémité postérieure surpasse cinq ou six fois leur hauteur.”

downwards, were about half an inch in length, were very imperfectly developed, and could scarcely be distinguished in the strong fibrous membrane attached to the vertebræ along the line of junction of these processes with the bodies of the vertebræ and uniting all the transverse processes of the same row together. These two strong fibrous laminae passed down on each side of the kidneys, and converged along their lower edge so as to form a canal inclosing them. There were no ribs present. The inferior spinous processes of the vertebræ were slender and quite flexible, presented the appearance of cartilage to the unaided eye, were united together by a dense fibrous membrane, and were directed obliquely backwards. The longest were situated opposite to the vent, and were more than two inches in length. About two-thirds of the cavity between each pair of vertebræ formed by the junction of the cup-shaped excavations before and behind, was filled up by a white gelatinous substance, of the shape of a double cone like the cavity containing it, the apices of which were attached to the bottoms of the cup-shaped excavations, and in fact extended along a canal traversing the centre of the bodies of the vertebræ, so that in this way the white gelatinous-looking substance was continuous along the whole length of the spinal column, and formed alternate bulgings and contractions,—the bulgings corresponding to the widest part of the bi-conical cavity between each pair of vertebræ, the contractions to the canal perforating the centre of the body of each vertebra. This gelatinous substance was of the same structure as that found in the corresponding position in other fishes, but it was solid throughout, and contained no cavity in its interior for holding fluid. It possessed little elasticity, was soft and readily compressed, and could be broken down or torn into fragments by the exertion of a very moderate force. On making a transverse section of the body of one of the vertebræ (fig. 3), a number of narrow bands, generally eighteen in number, are seen radiating from a point near the centre to the circumference, and one of these runs to each of the longitudinal ridges on the external surface of the body of the vertebra. These radiating bands begin at the outer edge of a ring surrounding the white gelatinous substance occupying the centre of the body of the vertebræ like the pith in the centre of the trunk of a dicotyledonous tree; and the radiating bands may be compared to the medullary rays passing from the pith towards the circumference in the tree; but they differ in this, that the radiating bands in the vertebræ are composed, as we shall point out afterwards, of a structure of a very different character from that constituting the central gelatinous substance. Fig. 3 is a representation of

the appearances just described, as observed by the aid of a common pocket lens.

The posterior, lateral and superior walls of the cavity of the cranium appear to the unaided eye to be composed of fibro-cartilage, exhibiting no traces of a division into separate portions; and a deep groove extending between the superior margins of the orbits, runs along the whole of the superior surface of the cranium, in which the elongated nasal processes of the intermaxillary bones are contained. The floor of the anterior part of this groove is occupied by the cartilaginous anterior frontal bones, which are raised into a well-marked ridge in the course of the mesial line of the cranium. The two intermaxillary bones are united at the mesial line and are prolonged outwards and downwards along the margin of the mouth to the commissure of the lips. The two nasal processes of the intermaxillaries—one from each intermaxillary—extend backwards over the middle portion of the maxillary bones, along the groove on the superior surface of the cranium as far back as the crest of the superior occipital, becoming narrower as they proceed backwards. The posterior and middle portions of both these processes lie in and are firmly fixed in a single groove on the superior surface of a portion of cartilage exceeding them in depth as well as in thickness, which also sends downwards a very thin ridge along the centre of a deep and wide groove in the anterior portion of these processes. This portion of cartilage is also grooved along its inferior surface and in the same line with that in the nasal processes of the intermaxillaries, but the former is considerably less deep and wide than the latter. These two grooves can be made to move freely upwards and downwards over the ridges on the upper surfaces of the maxillary and anterior frontal bones, and the snout can be thus protruded or retracted. The difference between the structure of the fibrous nasal processes of the intermaxillary, and that of the portion of cartilage firmly embracing their posterior and middle portions, was very well marked*. The superior maxillary bone consists of two distinct parts. First, a central part placed in front of the vomer and anterior frontals and behind the body of the intermaxillary, loosely connected to the former by fibrous tissue, and more closely, but not sufficiently so to prevent motion between them, to the latter. It was in close apposition, but not immovably connected to its fellow of the opposite side, was about an inch and a half in length, and considerably broader at its anterior than at its posterior half, which was very narrow. The broadest part, which was a little behind the anterior extremity, was half an inch in breadth, and from its outer edge a broad thin plate of fibrous

* Is this mass of cartilage the homologue of the nasal bones?

texture was prolonged outwards and downwards towards the commissure of the lips, running posterior and parallel to the body of the intermaxillary. The inferior surface of the thin fibrous and superficial plate, with ridges on its external surface similar to the opercular bones, covering the sides of the cheeks, becomes inseparably blended with the superior surface of the lateral fibrous prolongation of the central portion of the superior maxillary. The second portion of the superior maxillary consists of two fibrous and flexible branches united together, where they are connected to the lateral part of the broadest portion of the central portion, by a moveable articulation, whence they diverge, the one proceeding to join the lower maxilla at the junction of its dental and articular portions, the other proceeding forwards and downwards to join the inferior maxilla at its symphysis. The bones of the head differed in their structure, but none of them contained ossific matter.

1. Some were composed of a thin, very flexible, fibrous lamina, presenting numerous ridges on their outer surface, arranged differently in each. This was the structure of the opercular bones, and of two quadrilateral plates, one on the surface of each cheek, placed immediately behind the anterior margin of the intermaxillary bone, united to each other by a portion without ridges on its external surface which passed over the dorsum of the snout and covered the anterior portion of the nasal processes of the intermaxillary. A thin and narrow porous layer of this tissue, apparently continued from the opercular bone, passed along the upper margin of the orbit.

2. Some were composed of a fibrous-looking tissue, either forming flexible plates and bands without any ridges, or masses of greater thickness. The palatine bones and a part of the maxillary bones consisted of thin broad plates, of this texture, while the body of the sphenoid, the anterior sphenoid, the vomer, the intermaxillary, and the central portions of both upper and lower maxillæ were formed of thicker masses of the same texture. The lower maxilla contained true cartilage in its interior.

3. Some were composed of true cartilage enveloped in an external layer of a fibrous-looking tissue. This was the structure of the lateral and posterior walls of the cavity of the cranium.

4. Some were composed throughout of true cartilage, having no fibrous envelope except that constituting the perichondrium. This was the structure of the anterior frontals, and the portion of cartilage firmly embracing the posterior and middle portions of the nasal processes of the intermaxillary.

The branchiostegous membrane is short, and contains four short, very flexible and thin branchiostegous rays, besides three others very indistinctly marked placed posterior to these.

The scapular arch is very flexible, rather slender, composed of a fibrous-looking tissue, is united to the skull at one point only—to the mastoid bone,—and is continuous throughout its whole length, so that it presents no traces of division into separate portions. About $2\frac{1}{2}$ inches from the lower edge of the body, the scapular arch bifurcates, and the two branches diverge and proceed to the lower edge of the body, and are 2 inches apart at their termination. The anterior of these two branches is the stronger, and the pectoral fin is attached to it, a little below the bifurcation.

Muscular System.—The muscular bundles of the trunk are enveloped in several strong fibrous sheaths, formed by prolongations inwards of the fibrous part of the chorion or true skin, attached to the spinal column and to the strong laminæ prolonged upwards and downwards along the processes of the spinal column. The muscles of the two sides of the body nearly throughout its whole height, are separated by a very strong fibrous partition extending upwards from the upper part of the bodies of the vertebræ along the whole length of the spinous processes, and enveloping that part of the lower extremities of the interspinous or interneural spines interposed between these processes; and extending downwards from the lower part of the bodies of the vertebræ along the transverse processes and inferior spinous processes as far as they go, and thence continued onwards to the warty-looking cartilaginous tubercles arranged along the lower edge of the body. In the region of the abdomen this partition divides itself into two parts, forming the fibrous lining of the inner surface of the abdominal walls. Three strong aponeurotic septa are sent inwards from the inner surface of the skin to that part of this central partition placed above the spinal column, and two to that part below it, throughout a great part of its length. Another septum is sent inwards from the skin along the lateral line of the body to the spinal column, which is attached along the roots of the transverse processes in the abdominal vertebræ, and to the central ridge on the bodies of the caudal vertebræ. There are thus three strong sheaths containing muscular bundles placed between the bodies of all the dorsal and the greater part of the caudal vertebræ and the upper extremities of their superior spinous processes, and two similar sheaths between the bodies of a great part of the caudal vertebræ and the lower extremities of their inferior spinous processes. The space between the uppermost of these sheaths and the superior margin of the body contains the muscular bundles which move the dorsal fin rays, and the space between the lowermost of these sheaths and the inferior margin of the body contains a thin layer of muscular fibres which is attached to the central partition, to

numerous small fibrous septa sent inwards from the inner surface of the skin, and to the inner surface of the skin. Bundles of these muscular fibres may be seen at some parts of the abdominal walls running between the skin and aponeurotic lining of the abdomen separated by numerous aponeurotic septa. Septa are also sent inwards from the inner surface of the skin to the interneural spines, separating each pair of muscles which move the dorsal fin rays, and numerous small septa are also at some places sent inwards from the skin among the muscular bundles filling up the fibrous sheaths. The strong central partition, and the fibrous prolongations inwards of the skin impart an amount of strength to the whole body, and afford an extent of firm attachments to the muscular bundles, which the imperfectly developed neuro-skeleton could not of itself have supplied. Of the three uppermost muscular sheaths, the lower one, immediately behind the occiput, is very much wider than the other two. Opposite the ninth vertebra they were nearly equal in width and measured each about $\frac{8}{10}$ ths of an inch, but on proceeding backwards the upper and lower diminished in width much more rapidly than the middle, so that opposite the thirty-sixth vertebra while the middle measured $\frac{7}{10}$ ths of an inch in width, the lower measured only $\frac{2}{10}$ ths and the upper $\frac{3}{10}$ ths of an inch. The upper muscular sheath lies over the upper extremities of the spinous processes of the vertebræ, and the portion of the lower extremities of the interneural spines and of the muscles of the dorsal fin rays interposed between these. Of the two undermost muscular sheaths, or those placed below the lateral line of the body, the one next the spine is much narrower than the lower.

The microscopic examination of the tissues of this animal furnished some interesting results.

Skin.—The skin is thin, being about $\frac{1}{8}$ th of an inch in thickness, is in close contact with the subjacent muscular bundles, and is destitute of scales. It may be divided into two parts—an epidermic portion and the chorion or true skin. The more external of these, or the epidermic portion, may also be subdivided into two parts. One of these is composed of thin, narrow and elongated fibres (fig. 2), upon the presence of which the bright silver colour of the skin depends. These fibres are arranged in bundles, are firmly agglutinated together, those of the same bundle run parallel or nearly so to each other, and have one of their flat surfaces looking outwards, and the other towards the subjacent layer of the skin. A layer of similar fibres covers the anterior surface of the iris, giving it a bright silvery colour. It is very difficult to separate these fibres from each other, and in attempting this they were generally broken into fragments of greater or less size. Those of the iris were not so firmly agglu-

minated together as those on the skin. I did not succeed in making any accurate measurements of these, but some of them were about $\frac{1}{3000}$ th of an inch in breadth, the greater number however, were narrower than this, and the longest about $\frac{1}{100}$ th of an inch in length. They dissolve in aqua potassæ, and when subjected to the action of diluted muriatic acid under the microscope no bullæ of gas were evolved, indicating that they are composed of animal membrane. When detached they do not exhibit any metallic lustre when examined by transmitted light, but do so when examined by reflected light. Sir David Brewster had the kindness to give me the following report upon the optical properties of these fibres:—"Having had occasion to examine by the microscope the colouring matter of different fishes, I was surprised to observe that the colouring matter of the Vaagmaer which you were so good as to send me presented phænomena different from what I had seen before. When removed from the skin and separated from the membrane with which it is connected, it was resolved into a great number of short and minute prisms, whose length was about six or eight times their breadth. These prisms had regular axes of double refraction, and absolutely disappeared under the polarizing microscope when the plane of primitive polarization was either parallel or perpendicular to the axis of the prism. The phænomena which these prisms exhibited were quite different from those shown by animal and vegetable fibres which have a doubly refracting structure. I am disposed to think that the prisms are analogous in their composition to shell. The metallic lustre which the skin of the Vaagmaer displays is doubtless owing to a great number of surfaces from which the incident ray is reflected, the rays transmitted through one prism being reflected from the surfaces of those which lie beneath it."

These fibres, which give the metallic lustre to the external surface of the body and to the anterior surface of the iris*, appear to me to be similar, but on a much larger scale, to the crystal-looking spicula which impart the metallic lustre to the scales, to the anterior surface of the iris, and to the membrane between the *choroid and sclerotic coats of the eyeball* in some fishes. The external surface of the small portion of each scale which is not overlapped by its fellows is, in the haddock (*Morrhua æglefinus*) invested by a structure bearing a great affinity to the epidermic layer of the Vaagmaer. This structure consists of a membrane or thin layer having little spots of dark pigment cells placed at short and nearly equal distances from each other, each spot presenting in general a stellated arrangement. Imbedded and fixed on the surface of this membrane are numerous small bodies,

* In the Vaagmaer I observed no metallic-looking layer between the sclerotic and choroid coat of the eyeball.

several times longer than they are broad, and measuring in length from $\frac{1}{1000}$ th to $\frac{1}{700}$ th of an inch, which, when detached and mixed with water, give it a milky appearance. In the colouring layer on the anterior surface of the iris and in the metallic-looking layer between the choroid and sclerotic in the eyeball of the haddock, the cod (*Morrhua vulgaris*), the flounder (*Platessa flesus*), and the common dab (*Platessa limanda*), these spicular-looking bodies are very numerous, are arranged in bundles, and are connected together by a substance having no definite structure. The colouring layer between the choroid and sclerotic has a fibrous appearance from the manner in which these bodies and their connecting substance are arranged. This layer in the iris is not so distinctly fibrous in its arrangement as that between the choroid and sclerotic. In the common dab they are, in the latter position, similar to those from the scale of the haddock. The spicular-looking bodies that give the metallic lustre to the silvery membrane lining the abdomen in some fishes, and also placed below the external integuments in others as in the haddock, are considerably smaller than those on the scales and in the eyeball. These colour-giving fibres seem to be commonly regarded as crystals. Ehrenberg states that the colouring matter of the peritoneal membrane of the fish consists of prismatic crystals ten times as long as they are thick, the longest of which are about $\frac{1}{96}$ th of a line in length, but this varies in different kinds of fish; and similar crystals, but somewhat larger, are obtained from the silvery membrane of the sclerotic and of the anterior surface of the iris*. Henle† and Hannover‡, in speaking of those in the metallic-looking layers of the eyeball in fishes, term them crystals. Mandl states that "the silvery matter disposed on the inferior surface of the scale upon a peculiar membrane consists of crystals;" and he has given a representation of them in fig. 8. of pl. 10 of his memoir on the Appendices of the Skin§.

* Poggendorff's *Annalen der Physik und Chemie*, Band xxvii. S. 468-9, 1833. H. Rose analysed some of this colouring substance obtained from the pike furnished to him by Ehrenberg, and arrived at the conclusion that it was a peculiar organic substance (*opus cit.* pp. 470-1).

† Müller's *Archiv für Anatomie, Physiologie, &c.* Jahrgang, 1839, S. 387.

‡ Müller's *Archiv für* 1840, p. 332.

§ Mandl's *Anatomie Microscopique*. *Mémoire sur la Structure intime des Appendices tégumentaires*, p. 89, 1840. Dr. Drummond (*Transactions of the Royal Society of Edinburgh*, vol. vii. p. 377, 1815), struck with the peculiar revolving movements which these spicula obtained from the scales and eyes, like so many other minute bodies when suspended in fluid, exhibit, was inclined to believe that they are endowed with "*animalcular* life." Reaumur (*Mémoires de l'Académie Royale des Sciences*, 1716, p. 229) has given a description of this silvery matter in the scales and the abdominal membrane of fishes, but he did not detect the form of these spicula, and he supposed that they were placed within tubes.

Though no doubt these spicular-looking bodies have the aspect of crystals and retain their shape when dry, yet I believe that they are composed of an animal texture similar to those fibres that give the silver colour to the external surface and to the anterior surface of the iris in the *Vaagmaer*. These spicular-looking bodies taken from all the situations above-mentioned rapidly disappear under the action of aqua potassæ, and when subjected to the action of dilute muriatic acid under the microscope, though they disappear, no evolution of gas is observed. In subjecting those from the scales to the action of the diluted muriatic acid, care must be taken to exclude any part of the scale itself, as bullæ of gas are evolved when the substance of the scale is acted on by the acid,—a result to be expected from their known chemical composition. Some of the bundles of these bodies procured from the coloured layer of the sclerotic in the common dab looked like those of the *Vaagmaer* in miniature.

Immediately below these fibres and placed next to the chorion or true skin there is a thin layer composed of a substance without any distinct structure, having nuclei imbedded in it. In this layer the external fibres are formed. On its surface and between it and the bundles of external fibres are numerous spots of black colouring matter, placed at short and in general regular distances from each other, imparting, I believe, the leaden hue to the bright silvery lustre of the external fibres. When this dark matter is accumulated in greater quantities at any part, the silvery lustre may give place to the dark leaden hue.

The next layer is the chorion or true skin, and may also be divided into two parts:—1. The more external of these contains the tubercles on the skin already described, and constitutes a minute network in the small interstices between these tubercles, as may readily be made out by the aid of a pocket-lens, when this layer has been detached from those above and below it. From ten to twenty bands of a dense fibrous tissue may be seen radiating from the circumference of one of these tubercles to those surrounding it, and being united by cross bands form a close network, the openings in which generally approach a round form. In the tubercles the meshes of this network expand, become united into a continuous membrane, and form their external covering. This external covering of the tubercle becomes somewhat thinner in the centre, bulges outward and forms internally a shallow rounded excavation with a well-defined edge, occupying about two-thirds of its area. A texture differing in some respects from true cartilage, but composed of hyaline substance with some indistinctly-defined corpuscles scattered through it, fills up this shallow excavation, extends outwards beyond its margin to the circumference of the tubercle, forms a small bulging or projec-

tion posteriorly, and in fact constitutes the chief and characteristic part of the tubercle. In stripping off the subjacent layer of the skin, some of those minute masses constituting the chief part of these tubercles may adhere so firmly to it as to be torn off along with it. The bands forming the network are composed of fibres so very closely aggregated, that it is only after they have been mechanically separated that the fibres become distinctly visible. 2. The lower layer of the chorion is composed of a dense areolar tissue assuming an aponeurotic appearance, the fibrous arrangement of which is very apparent under the microscope. These fibres can be readily separated from each other, and are arranged in two distinct layers, in each of which the fibres run parallel to each other, and cross those of the other layer at right angles. It is this aponeurotic portion of the skin which is prolonged inwards among the muscles to form intermuscular septa, and to assist in the formation of the muscular sheaths previously described. Properly speaking this aponeurotic layer ought not to be described as constituting a portion of the chorion, but it is so closely united to it, that it requires a careful dissection to separate them. The difference between the texture forming the network and the external covering of the tubercles in the upper layer of the chorion, and the aponeurotic fibres constituting what we have just described as the lower layer of the chorion, is very marked when the polarizing prisms have been fixed in the microscope, from the very dissimilar colours which these two textures then exhibit.

The skeleton did not contain any osseous texture, but was composed of cartilage, of fibrous tissue, and of a remarkable structure which was entirely new to me. True cartilage was found in some of the bones of the head, in the upper ends of the interneural spines, in the articulating discs of the dorsal fin rays, and in the vertical cartilaginous plate at the end of the caudal vertebræ. None of the vertebræ contained any true cartilaginous tissue, except the fifty-ninth and sixtieth, in which the gelatinous-looking substance in the cup-shaped cavities was changed into true cartilage, and which also presented the other peculiarity already pointed out of being considerably shorter than those immediately preceding and following them. The cartilaginous plate at the end of the caudal vertebræ, the upper extremities of the interneural spines, the articulating discs of the dorsal fin rays, and the bones of the head previously enumerated were entirely composed of true cartilage, while some of the bones of the head were composed of true cartilage internally, and were covered externally by a layer of the peculiar textures about to be described. True cartilage, as has already been mentioned, exists in the dermo-skeleton, viz. in the warty-looking tubercles attached along the lower margin of the body of the animal. The relative amount

of the hyaline and the cellular elements varied in the cartilaginous texture in these different situations, but in most of it the nucleated cells were very abundant.

The surface of the transverse section of a vertebra (fig. 3) exhibits four different textures:—1. It is enveloped externally in a layer of dense areolar tissue, which also lines the interior of the cup-shaped cavities at the anterior and posterior ends of the vertebra. 2. The centre is occupied by a portion of the same gelatinous-looking substance which is seen in larger masses in the biconical cavities existing between each pair of vertebræ. 3. The walls of the narrow central canal containing this gelatinous-looking substance consist of a peculiar, dense, flexible and strong structure which is prolonged outwards to the circumference in the form of rays (fig. 3). 4. The intervals between these rays are filled up by a compact but much less resisting structure, which when torn up by the needles appears to be chiefly composed of very fine fibres mixed with granules. The gelatinous substance in the biconical cavities between the bodies of the vertebræ, and filling up the narrow central canal in the body of each vertebra, is of the same intimate structure as the gelatinous substance occupying a corresponding position in the spinal column of other fishes*. The texture which forms the rays as it proceeds outwards from the centre generally assumes the form of a waving band (fig. 4), which soon begins to bifurcate and reunite alternately at short intervals, presenting the appearance of a chain (fig. 4), the links of which, however, are frequently longer in the transverse than in the longitudinal direction. This chain with single links in its turn becomes a chain with double links (fig. 5), and when it reaches the circumference of the body of the vertebra its breadth has been increased by the addition of two or three more links. This appearance of a chain is caused by the transverse section of parallel tubes of a hexagonal and quadrilateral shape (the former is the prevailing one) composed of this dense structure, and the links of the chain are the cut edges of the tubes. On making thin sections of the body of the vertebra in the longitudinal direction, a number of dark parallel lines may be observed (fig. 6 *a*) without any distinct indication of the presence of this tubular structure, and when a favourable slice has been procured, as represented in fig. 6, where the tubes have been cut across and a part of their course exhibited, the manner in which these dark lines are produced becomes apparent. The vertical walls (vertical in the position in which the portion under examination is placed) of these quadrilateral and hexagonal tubes must be much thicker than the transverse, seeing that the empty spaces of the tubes are interposed between the latter, while the former

* It is composed of large cells of irregular shape from lateral compression, having no distinct nuclei.

extend through the whole height of the tubes, and the light is transmitted freely through the transverse, and imperfectly along the lines occupied by the vertical walls. This remarkable texture enters very largely into the formation of the skeleton, being found not only in the bodies of the vertebræ but also in the inferior and superior spinous processes, in the lower and middle parts of the interneural spines, and in much the greater number of the bones of the head. It is also present in the dermo-skeleton, for excluding those bones of the head which some regard as forming a part of the dermo-skeleton, it is found in the lateral line of the body. This texture is chiefly arranged in the form of bands or plates and tubes; and in the series of little elevations placed on the lateral line of the body it forms masses, from which branches pass forwards and backwards along this line. The most frequent form in which it presents itself is the tubular. I have stated that this texture is very strong, and it requires considerable force to break it up by the needles. It is composed of a hyaline texture, having, in some parts at least, some pale indistinct corpuscles scattered through it, so that though in some respects it approaches the cartilaginous tissue, it could be very readily distinguished from the true cartilage found in some other parts of the body of the animal, chiefly from the absence of the nucleated corpuscles or cells. One of the best methods of obtaining a good view of this tissue in the vertebræ is to subject the parts containing it under examination to the action of aqua potassæ, which does not affect it, while it dissolves the surrounding texture. As this structure depolarizes the light, when Nicol's polarizing prisms are adapted to the microscope, the difference between its colour and that of the surrounding textures sometimes brings out its arrangement very distinctly. The size of the tubes formed by this tissue and the thickness of their walls varies. The walls of some which I measured in the vertebræ were about $\frac{1}{1000}$ th of an inch thick, and the calibre of the tube was about $\frac{1}{170}$ th of an inch in its longest and $\frac{1}{250}$ th of an inch in its shortest diameter. The inferior spinous processes, and the lower parts of those superior spinous processes I examined, seemed entirely composed of this tissue arranged in the form of tubes similar to those in the vertebræ, running parallel to each other, so that a longitudinal section of them presented a number of parallel longitudinal lines with spaces between them, while a transverse section exhibited a reticulated appearance, produced by the open mouths of the cut tubes. In the upper portion of the superior spinous processes, and the greater portion of the interneural spines, it was chiefly arranged in the form of one large tube, of a circular form generally, the interior of which was, in the spinous process, filled up with a structure presenting all the appearance of cartilage having numerous nucleated corpuscles (fig. 8), while in the inter-

neural spines this tube was filled up with another texture presenting an indistinct cellular appearance having some pretty large and distinct nucleated cells dispersed through it (fig. 7), approaching the cartilaginous texture, yet decidedly differing from it*. The walls of this tube were thinner in the superior spinous processes than in the interneural spines, and in both (figs. 7 and 8) bands passed outwards from its circumference, which in the interneural spines sometimes assumed the form of the single chain, similar to what has been represented in fig. 4. Quadri-lateral and hexagonal hyaline tubes, combined with a greater or less proportion of the fibrous and nucleated tissue which fills up the intervals between the rays in the body of the vertebræ, enter into the formation of many of the bones of the head, while portions of some of them, as the nasal processes of the intermaxillaries, and portions of the body of the sphenoid, and the anterior sphenoid, and some parts of the superior maxillary, are entirely composed of these tubes closely aggregated together. Several bones which consist internally of true cartilage, as those composing the posterior, lateral and superior walls of the cranium, the hyoid and inferior maxilla, are covered externally by a layer of these tubes intermixed with the fibrous and nucleated tissue. In the bones of the cranium this covering is confined to the external surface. The branches of the superior maxilla which go to join the inferior maxilla are not covered by skin, but by a dense firm layer made up of these tubes. This tubular structure also abounds in the branchial arches, in the scapular arch, in the opercular bones, and in the branchiostegous rays, all of which structures are destitute of true cartilaginous and osseous tissues.

EXPLANATION OF PLATE XVI.

- Fig. 1.* Part of the digestive tube slit open. The commencement of the large intestine has been detached and separated from the posterior end of the stomach: *a*, pyloric portion of stomach; *b*, *cul de sac* of stomach; *c c*, second portion of small intestine; *d*, cæca surrounding duodenum or first portion of the small intestine; *l*, duodenum; *g*, lower portion of œsophagus; *h*, valve at the termination of the small in the large intestine; *m*, commencement of large intestine; *o*, spleen.
- Fig. 2.* Fibres, greatly magnified, from the external surface of the skin, upon which its silvery lustre depends.
- Fig. 3.* Transverse section of an abdominal vertebra.
- Figs. 4, 5 and 6.* Representations greatly magnified of a peculiar hyaline tissue entering largely into the formation of the skeleton.
- Fig. 7.* Peculiar structure seen in a transverse section of the interspinous bones.
- Fig. 8.* Peculiar structure seen in a transverse section of the spinous processes of the vertebræ.

* The smaller tubes formed by this dense hyaline substance, such as those in the bodies of the vertebræ, in some instances, if not in all, contain more or less of a soft substance without any distinct structure in which some granules are imbedded.

XLVIII.—*The Musci and Hepaticæ of the Pyrenees.*

By RICHARD SPRUCE.

[Continued from p. 380.]

Tribus 20. BRUCHIACEÆ, C. Muell.

44. *Astomum*, Hampe.

256. *A. nitidum*, Hedw. Musc. Frond. i. t. 34 (sub *Phasco*); Br. Europ. *Phascum*, p. 12. t. 6; M. P. 322.

Hab. Z₀₋₁ P. c. in argillosis humidis secus viarum latera in valle Trébons, rarissime! P. occ. circa Dax (Grateloup in Fl. Française).

257. *A. alternifolium*, Brid. Mant. Musc. p. 10 (sub *Pleuridio*). *Phascum altern.*, Br. Europ. ! l. c. p. 15. t. 7 (non Dicks., nec Schwgr.).

“Var. 1, antheridiis in floribus cauligenis gemmiformibus; etiam paraphysibus absque antheridiis (rarissime antheridiis nonnullis abortivis adjectis) in axillis foliorum superiorum dispositis;” M. P. 323.—*Hab.* Z₁ in arenosis humidis circa Jurançon.

“Var. 2, antheridiis absque paraphysibus in floribus gemmiformibus, et insuper antheridiis paraphysatis numerosis (nonnunquam *quinis*) in foliorum superiorum axillis;” M. P. 324.—*Hab.* Z₀₋₁ in arenosis circa St. Sever, Pau et B.-de-Bigorre.—“Florescentia valde variabilis; species distincta tamen a *Ph. subulato* foliis perichætialibus videtur. Confer Br. Europ.,” M. P. l. c.

The inflorescence of *Phascum alternifolium* and of several other mosses (*e. g.* certain *Brya*) is by no means so constant to the type assigned in ‘*Bryologia Europæa*’ as the authors of that work would lead one to suppose; and fully prepared as I am to acknowledge the importance of the characters derived from the inflorescence, it appears to me that science will lose rather than gain if we shut our eyes to the aberrations which it undeniably presents. To assume a greater degree of invariableness in the inflorescence than exists in any other part of the plant, is as illogical as in practice it is found to be inaccurate.

Tribus 21. SELIGERiaceÆ.

(*Seligeriaceæ* et *Campylosteliaceæ*, Bryol. Europ.)

45. *Campylostelium*, Bryol. Europ.

258. *C. saxicola*, W. et M. Bot. T. p. 167 (sub *Dicrano*); Br. Europ. *Campylost.* p. 3. t. 1.

Hab. Z₂ P. c. locis umbrosis in saxis arenaceis. Labassère. V. de Castelloubon.

46. *Brachyodus*, Fürnrohr.

259. *B. trichodes*, Mohr, Crypt. Gew. p. 85 (sub *Gymnostomo*);

Br. Europ. *Brachyodus* (cum icone). *Weisia trichodes*, H. et T. !
Musc. Brit. p. 82. t. 15 ; M. P. 228.

Hab. Z_1 P. c. in rupibus argillaceo-schistosis prope thermas
dict. de Salut, B.-de-Bigorre, rarissime.

47. *Seligeria*, Bryol. Europ. (ex parte).

260. *S. Doniana*, Smith, E. Bot. t. 1582 (sub *Gymnostomo*) ;
C. Muell. Syn. Musc. p. 420. *Anodus Donianus*, Br. Europ.
(cum icone).

Hab. Z_1 P. c. in rupibus calcareis occultis prope B.-de-Bigorre
(Philippe !).

261. *S. pusilla*, Hedw. Musc. Frond. ii. t. 29 (sub *Weisia*) ;
Br. Europ. *Seligeria*, p. 4. t. 1 ; M. P. 227.

Hab. Z_{1-3} P. occ. in rupibus calcareis udis ad *Narcastet* prope
Pau. P. c. in rupibus schistosis vallis *Castelloubon* et in ascensu
ad *Port de Bénasque*.

262. *S. recurvata*, Hedw. Musc. Frond. i. t. 38 (sub *Grimmia*) ;
Br. Europ. *Seligeria*, p. 6. t. 3 ; M. P. 229.

Hab. Z_1 P. c. in rupibus graniticis et arenaceis, locis *Gavar-*
nie, *V. de Castelloubon* et *Lesponne*, *Labassère* et *Superbagnerès*.

Tribus 22. DICRANACEÆ, Bryol. Europ. (ex parte).

48. *Ceratodon*, Bridel.

263. *C. purpureus*, Linn. (sub *Mnio*) ; Br. Europ. *Ceratodon*,
p. 5. t. 1, 2. *Dicranum purpureum*, Hedw. Sp. Musc. p. 136. t. 36.

Hab. Z_{0-4} ad terram, in habitationum vicinia præcipue, socio
Funaria hygrometrica.

264. *C. cylindricus*, Hedw. Sp. Musc. t. 24 (sub *Trichostomo*) ;
Br. Europ. l. c. p. 6. t. 3 ; M. P. 201. *Angstræmia cylindrica*,
C. Muell. Syn. Musc. p. 441.

Hab. Z_1 P. c. in rupibus arenaceis fragilibus montis *Superba-*
gnères : nusquam alias observatus.

49. *Cynodontium*, Bryol. Europ.

265. *C. Bruntoni*, Smith, E. Bot. t. 2509 (sub *Dicrano*) ; Br.
Europ. *Cynodontium* (cum ic.) ; M. P. 210. *Didymodon obscu-*
rus, Kaulf. ; Grev. ! Scot. Cr. Fl. t. 193.

Hab. Z_1 in sylvis, rupestre. P. occ. *Bagès* prope les *Eaux*
Bonnes. P. c. *V. du Lys* ; *Bois de Gouerdère* ; *V. de Lesponne*
(Philippe !). P. or. in radice montis *Canigou* (Montagne !).

50. *Dicranum*, Hedwig.

§ 1. POLYCARPA, Br. Europ.

266. *D. polycarpum*, Hedw. Musc. Frond. ii. p. 85. t. 31 (sub
Fissidente) ; M. P. 209.

Hab. $Z_{1\text{ sup.}-2}$ in virgultis, rupestre.

Var. β . *strumiferum*, Br. Europ. *Fissidens strumifer*, Hedw.
—*Hab.* in rupibus umbrosis convallium *Jéret* et *Castelloubon*.

§ 2. VIRENTIA, Br. Europ.

267. *D. virens*, Hedw. Musc. Frond. iii. p. 77. t. 32.

Hab. Z_{2-3} P. c. in sylvis humidis vallis *Lesponne* (Dufour ! Philippe !). P. or. *V. d'Eynes* (Arnott !).

§ 3. SQUARROSA, Br. Europ.

268. *D. flavescens*, Dicks. Crypt. fasc. 2. p. 4 (sub *Bryo*). *Dicranum flav.*, Smith ! Fl. Brit. p. 1224 et E. Bot. t. 2263 ; M. P. 213. *D. pellucidum* var. γ . *serratum*, Br. Europ.

Hab. $Z_{1\text{sup}}$ P. occ. in arena torrentis ad latus boreale montis *Goursi* prope *les Eaux Bonnes*. P. c. loco simili vallis *Lesponne*.

269. *D. pellucidum*, L. Sp. Pl. p. 1583 (sub *Bryo*) ; Schwgr. Suppl. t. 48 ; M. P. 214.

Hab. Z_{1-2} in rivulorum glareosis.

270. *D. squarrosus*, Schrad. Bot. Journ. v. p. 68 ; Br. Europ. *Dicranum*, p. 17. t. 5. *Angstræmia squarr.*, C. Muell. Syn. Musc. p. 438.

Hab. Z_{1-2} in arena rivulorum : haud vulgare et semper absque fructu. *V. de Lesponne*, &c.

§ 4. CRISPA, Br. Europ.

271. *D. Schreberi*, Hedw. Sp. Musc. p. 144. t. 33 ; Br. Europ. l. c. p. 18. t. 6. *Angstræmia Schr.*, C. M. Syn. Musc. p. 438.

Hab. Z_{0-1} P. occ. in rupibus ophiticis humidiusculis *Sti. Pandelon* prope *Dax* : fertile sed rarissimum. P. c. ad terram in occultis prope *B.-de-Bigorre* : sterile.

§ 5. RUFESCENTIA, Br. Europ.

272. *D. varium*, Hedw. Musc. Frond. ii. t. 34 ; M. P. 222. *Angstræmia varia*, C. M. Syn. Musc. p. 435.

Hab. Z_{0-1} in terra nuda subhumida, haud vulgatum.

273. *D. rufescens*, Turn. Musc. Hibern. p. 66 ; Smith ! Fl. Brit. p. 1210, et E. Bot. t. 1216 ; M. P. 223. *Angstræmia ruf.*, C. M. Syn. Musc. p. 436.

Hab. Z_1 P. occ. et c. in argillaceo-arenosis circa *Pau* et *B.-de-Bigorre*, sat frequens.

§ 6. HETEROMALLA, Br. Europ.

274. *D. curvatum*, Hedw. Sp. Musc. t. 31 ; M. P. 221. *Angstræmia curv.*, C. M. Syn. Musc. p. 433.

Hab. Z_{1-2} P. c. in declivibus graminosis umbrosis vallis *Lesponne* et monticuli *Olivet*, ut et in sylva dict. *Bois de Gouerdère* : socio *Trichost. homomallo*. P. occ. ad terram in valle *Jéret*.

275. *D. heteromallum*, L. Sp. Pl. p. 1583 (sub *Bryo*) ; Br.

Europ. *Dicranum*, t. 15. *Angstroemia heter.*, C. M. Syn. Musc. p. 432.

Hab. Z_{0-2} in solo arenaceo.

Var. *cæspitibus elongatis compactis*; capsulis nonnullis subrectis; M. P. 220.—*Hab.* in rupibus ophiticis et arenaceis P. c. locis *Labassère et Superbagnères*.

§ 7. FALCATA, Br. Europ.

276. *D. Starkii*, W. et M. Bot. T. p. 189; Br. Europ. *Dicranum*, p. 27. t. 17. “*D. falcatum*,” M. P. 219.

Hab. Z_{3-4} in montibus editioribus, rupestre. P. c. *Mt. Maladetta*; *Mt. Crabioules*; *Esquierry*; *Lac d'Espingo*; *En montant au Lac Lehou* (Dufour!). P. or. loco non designato (Arnott!).

I gave this in ‘*Musci Pyrenaici*’ as *D. falcatum*, as being the older name and under the supposition that *D. Starkii* was not a distinct species; but I had then seen no *authentic D. falcatum*. The latter I am now convinced differs essentially in the smaller size, the *more rigid habit*, the *leaves more strongly and uniformly hooked*, with slenderer points, not flexuose when dry; the *shorter and redder capsules*, which are not subcylindrical but *obovate*, and are *not strongly sulcate when dry*; lastly in the redder teeth, which are also wider and less deeply cloven.

277. *D. falcatum*, Hedw. Sp. Musc. t. 32; Br. Europ. *l. c.* t. 18.

Hab. Z_{3-4} P. c. secus lacus *Lehou ripas* (Philippe!).

§ 8. ORTHOCARPA, Br. Europ.

278. *D. montanum*, Hedw. Sp. Musc. p. 145. t. 35. “*D. flagellare*, Hedw.” M. P. 208.

Hab. Z_1 P. occ. et c. ad truncos vetustos in sylvis supra pagum *Jurançon* et circa *B.-de-Bigorre*.

279. *D. fulvum*, Hook. Musc. Exot. t. 149; Sullivant! Musci Allegh. n. 159; M. P. 207. *D. interruptum*, Brid. Musc. Rec. 2. P. 1. p. 159, fide Bryol. Europ. (non *D. interruptum*, Smith! Fl. Brit. p. 1205).

Hab. Z_1 sup. P. c. ad saxa granitica in sylvis convallium *Burbe* et *du Lys* prope *B.-de-Luchon*.

280. *D. Sauteri*, B. et S.! Br. Europ. *l. c.* p. 33. t. 24; M. P. 206.

Hab. Z_{2-3} P. occ. in abiegnis nigris vallis *Jéret*; P. c. in regione inferalpina montis *Crabioules*: saxa granitica obtegens.

281. *D. longifolium*, Hedw. Musc. Frond. 3. p. 24. t. 9; M. P. 205.

Hab. Z_2 P. c. ad saxa granitica in nemore nigro secus cataractam dict. *Cascade du Cœur*, etiam in monte *Superbagnères*. P. or. *Port Nègre* (Arnott!).

§ 9. SCOPARIA, Br. Europ.

282. *D. scoparium*, Linn. ! Sp. Pl. p. 1582 (sub *Bryo*). *Dicranum scop.*, Hedwig ; Smith ! Fl. Brit. p. 1201 ; Br. Europ. *l. c.* t. 26 ; M. P. 217.

Hab. Z_{1-2} in sylvaticis, copiose.

283. *D. fuscescens*, Turn. ! Musc. Hibern. p. 60 (1804) ; Smith ! Fl. Brit. p. 1204 (1804), et E. Bot. t. 1597 ; M. P. 218. *D. congestum*, Brid. Sp. Musc. 1. p. 176 (1806) ; Br. Europ. *l. c.* t. 29.

Hab. $Z_{1 \text{ sup.}-2}$ P. occ. ad rupes graniticas et argillaceo-schistosas in vicinia oppiduli *Cauterets*, locis *Pont d'Espagne* et *Gorge de Cauterets*.

§ 10. SPURIA, Br. Europ.

284. *D. spurium*, Hedw. Musc. Frond. 2. t. 20 ; Smith ! Fl. Brit. p. 1222, et E. Bot. t. 2167 ; M. P. 215.

Hab. Z_{0-1} P. occ. in ericetis Agri Syrtici loco *Landes de Mu-griet*, necnon in monte *Goursi*.

§ 11. UNDULATA, Br. Europ.

285. *D. undulatum*, Schrad. ; Smith ! Fl. Brit. p. 203 ; Sullivan ! Musci Allegh. n. 156. *D. polysetum*, Sw. Musc. Suec. p. 34 et 87 ; Schwgr. Suppl. t. 41 ; M. P. 216.

Hab. Z_1 in campis sylvarum gramineis, semper absque fructu. P. occ. *Bois de Jurançon*, &c. P. c. *V. de Serris*.

286. *D. majus*, Smith ! Fl. Brit. 3. p. 1202, et E. Bot. t. 1490 ; Br. Europ. *l. c.* t. 37.

Hab. Z_2 P. c. in rupibus umbrosis subhumidis vallis *Lesponne* : nullo alio loco in Pyrenæis mihi notum !

§ 12. (= ARCTOA, Br. Europ.)

287. *D. fulvellum*, Dicks. Crypt. fasc. 4. t. 11. f. 1 (sub *Bryo*). *Dicranum fulvellum*, Smith ; H. et T. ! Musc. Brit. p. 103. t. Suppl. 3 ; M. P. 224. *Arctoa fulvella*, Br. Europ. *Arctoa*, p. 4. t. 1 ; et *A. hyperborea*, Br. Europ. ! *l. c.* p. 5. t. 2.

Hab. Z_4 P. c. in rupibus subhumidis. *Esquierry*. *Crabioules*. *Lac Lehou*.

The Pyrenean specimens have the leaves of *Arctoa fulvella* (Br. Europ.), and the striated capsules of *A. hyperborea*. All the British specimens that I have seen under the name of *Dicranum fulvellum* have the capsule striated, while the leaves exhibit all intermediate forms between those attributed to *A. fulvella* and to *A. hyperborea* ; hence I do not hesitate to consider these two mosses mere forms of one and the same species.

51. *Blindia*, Bryol. Europ.

288. *B. acuta*, Hedw. Musc. Frond. 3. t. 35 (sub *Weisia*) ; Br. Europ. *Blindia* (cum ic.) ; M. P. 225.

Hab. Z₂ P. occ. et c. in rupibus humidis vallis Jéret, necnon ad rupes cataractæ *Cascade du Cœur* humectatas : rarior.

52. *Campylopus*, Bridel.

289. *C. longirostris*, W. et M. Bot. Tasch. p. 155 (sub *Didymodonte*) ; M. P. 202. *Cynodontium longir.*, Schwgr. Suppl. t. 29. *Dicranodontium longir.*, Br. Europ. fasc. 41 (cum icone). *Dicranum denudatum*, Brid. ; C. M. Syn. Musc. p. 403.

Hab. Z₁₋₂ P. occ. et c. supra ligna putrida, rarius ad rupes. *Vallées de Lutour et du Lys*, &c.

290. *C. fragilis*, Br. Europ. ? fasc. 41. p. 4. t. 2. *Dicranum Funkii*, C. M. Syn. Musc. p. 392.

Hab. Z₂ P. occ. in sylvis subhumidis circa les *Eaux Bonnes* : sterilis.

291. *C. atrovirens*, De Not. Syllab. Musc. p. 221 ; Br. Europ. fasc. 41. p. 5. t. 4. *Dicranum atr.*, C. M. Syn. Musc. p. 413.

Hab. Z₂ in sylvarum rupibus humidis, sterilis. P. occ. *Mt. Goursi*. P. c. *V. de Castelloubon*.

292. *C. longipilus*, Brid. Bryol. Univ. 1. p. 477 ; Br. Europ. fasc. 41. p. 6. t. 5 ; M. P. 203. *Dicranum longip.*, C. M. Syn. Musc. p. 411.

Hab. Z₁ P. occ. in saxis graniticis prope oppidulum *Laruns*.

†*C. elongatus*, Bridel : "caule indiviso elongato radiculoso-tomentoso apice fastigiato-ramoso, ramulis penicillatis, foliis caulinis inferioribus dissitis superioribus dense imbricatis omnibus appressis lineari-lanceolatis nervo latissimo obsoleto."

"*Hab.* circa *Dax* Aquitanix ubi D. Grateloup legit. Herb. Cand." Br. Univ. 1.

I suspect there is some mistake about the station attributed to this moss, which has a habit quite different from that of any European *Campylopus*. May it not have been inadvertently transposed from Dr. Grateloup's exotic Cryptogamia (from the Mauritius, Guadeloupe, &c.) to his collection of native French species ?

Tribus 23. WEISIACEÆ.

(*Weisiaceæ* et *Anæctangiaceæ*, Bryol. Europ.)

53. *Eucladium*, Bryol. Europ.

293. *E. verticillatum*, L. Sp. Pl. p. 1585 (sub *Bryo*) ; Br. Europ. *Eucladium* (cum ic.) ; M. P. 226.

Hab. Z₁ in declivibus calcareis subhumidis.

54. *Rhabdoweisia*, Bryol. Europ.

294. *Rh. fugax*, Hedw. Sp. Musc. t. 13 (sub *Weisia*) ; Br. Europ. *Rhabdow.* p. 4. t. 1. *Dicranum striatum*, M. P. 211.

Hab. Z_{1-2} P. occ. et c. ad rupes schistosas umbrosas, haud infrequens. In rupium madidarum fissuris faucium *Gorge de Caunterets* dict., pulcherrime!

295. *Rh. denticulata*, Brid. Suppl. Musc. 1. p. 108 (sub *Weisia*); Br. Europ. l. c. p. 5. t. 2. *Dicranum denticulatum*, M. P. 212.

Hab. Z_{1-2} in rupium fissuris P. c. circa *B.-de-Luchon*, locis *V. du Lys*, *Bois de Gouerdère* et *Lac de Séculéjo*.

55. *Weisia*, Hedwig.

296. *W. cirrhata*, Hedw. Sp. Musc. p. 69. t. 12; Br. Europ. *Weisia*, p. 9. t. 6; M. P. 230.

Hab. Z_0 P. occ. in *Pini Piceæ* trunco in Agro Syrtico loco *Landes de Mugriet*. *Les Terres des Landes* (Grateloup).

297. *W. crispula*, Hedw. Sp. Musc. p. 68. t. 12; Br. Europ. *Weisia*, p. 9. t. 7; M. P. 231.

Hab. Z_{2-5} per Pyrenæos in saxis graniticis et schistosis, e subalpinis usque ad nives æternas.

Var. β . *atrata*, Br. Europ. l. c. (= β . *nigrescens* et γ . *atrata*, Br. Germ. p. 67. t. 30); M. P. 232.—*Hab.* in rupium subhumidarum fissuris loco *Port de Bénasque*.

This moss is equally alpine and arctic, and there is scarcely any other which flourishes and fructifies in such high latitudes and altitudes. It was gathered abundantly in Captain Parry's northern voyages, and Wahlenberg remarks of it, "in alpibus omnibus altius ascendit prope nivem perennem, quam quis alius muscus (excepto forsan *Polytricho juniperino*)."

298. *W. viridula*, L. Sp. Pl. p. 1584 (sub *Bryo*); Brid. Br. Univ. 1. p. 334; Br. Europ. *Weisia*, p. 5. t. 2, 3. *W. controversa*, Hedw. Musc. Frond. 3. t. 5; M. P. 233.

Hab. Z_{0-2} in terra ubique.

"Var. foliis nervo crasso instructis; capsula inclinata, ovali et ovali-cylindrica, stomate subobliquo rubello; peristomii dentibus brevibus, irregularibus, albidis; floribus masculis gemmiformibus in ramis propriis terminalibus: rarissime antheridiis 1-2 in perichætio fæmineo;" M. P. 235.—*Hab.* in muris prope *Pau*, socio *Hymenost. tortili*.

This seems to be the var. δ . *amblyodon* of the 'Br. Europ.'; *W. amblyodon*, Brid. Br. Univ. 1. p. 805; *W. amblyodon*, *gymnostomoides* and *microdonta*, Br. Germ. t. 25 et 37. In the rigid habit and in the form of the leaves it precisely resembles *Hymenost. tortile*, along with which it grew.

299. *W. Wimmeriana*, Sendtner in Denkschr. d. Regensburg. (sub *Gymnostomo*); Br. Europ. *Weisia*, p. 4. t. 1. "*W. controversa* var. 2, antheridiis 2-3nis in axillis fol. superiorum dispo-

sitis ;" M. P. 234 ; et *Hymenostomum murale*, M. P. 236 (*forma hymenostomoidea*).

Hab. Z₁ P. occ. in arenosis circa Pau et Oloron ; No. 236. M. P. in muris prope Ste. Marie d'Oloron.

The moss published in 'Musci Pyrenaici' as *Hymenostomum murale* (n. sp.) I have ascertained to be a form of *Weisia Wimmeriana*. Not one of the capsules I at first examined showed the least trace of peristome, but by renewed search I have at length found a capsule in which there are a few pale rudimentary teeth, scarcely rising above the annulus. As some excuse for this, it may be mentioned that *Weisia Wimmeriana* was originally referred to *Gymnostomum* by both Sendtner and Schimper.

56. *Hymenostomum*, R. Brown.

300. *H. microstomum*, Hedw. Musc. Frond. p. 71. t. 30 (sub *Gymnostomo*) ; Br. Europ. *Hymenost.* p. 4. t. 1.

Hab. Z₁ ad terram, rarissime ! B.-de-Bigorre. Pyrénées Orientales (Montagne !).

301. *H. tortile*, Schwgr. Suppl. t. 10 (sub *Gymnostomo*) ; M. P. 237.

Hab. Z₁ inf. P. occ. in muris prope Pau. P. c. in rupibus calcareis juxta thermas dict. de Salut, B.-de-Bigorre. Circa Montpellier et Vaucluse (Arnott !).

57. *Gymnostomum*, Hedwig.

302. *G. calcareum*, H. et N. Bryol. Germ. p. 183. t. 10 ; Br. Europ. *Gymnostomum*, p. 6. t. 3, 4 ; M. P. 239.

Hab. Z₁ in calce arenato murorum ad pedem Pyr. occidentali-um.—Var. β . *tenellum*, Br. Europ. l. c. ; Pau, Jurançon, &c.—Vars. γ . *viridulum* (= *G. viridulum*, Brid.) et δ . *gracillimum* (= *G. gracillimum*, Br. Germ.) ; Rontignon et Pau.

This species varies exceedingly in the length of the leaves and in the form of their apices. A small variety on walls at Pau has the leaves shortly ligulate, mostly widest above the middle, and often quite rounded at the summit. In the village of Rontignon, which is seven or eight miles higher up the banks of the Gave de Pau, the varieties γ . and δ . grow intermixed, both having the leaves for the most part subacute. All the forms observed in the Pyrenees have far wider and shorter leaves than specimens I have received from the Alps, and I never once met with the form considered by Bruch and Schimper as the type of the species. [Confer 'Bryol. Europæa,' monogr. *Gymnost.* p. 7 ; where however it is said by mistake that my specimens were gathered "in schisto micaceo ;" but it is nevertheless true that the mortar used in the neighbourhood of Pau, being made of lime mixed with the sand of the Gave de Pau, contains particles of mica, granite, &c. brought down from the mountains by this stream and its tributaries.]

303. *G. rupestre*, Schwgr. Suppl. t. 10; H. et T. ! Musc. Brit. ed. 2. p. 19. t. Suppl. 2; M. P. 238.

Hab. Z_{1-2} in rupibus humidis tam calcareis tam argillaceo-schistosis, frequens. *Pierrefitte*; *Penticosa*; *Gavarnie*, &c. *V. d'Eynes* (Arnott!).

304. *G. curvirostrum*, Hedw. Musc. Frond. 2. t. 24; Br. Europ. l. c. p. 8. t. 7, 8; M. P. 240.

Hab. Z_{2-3} in rupibus humidis præcipue argillaceo-schistosis. P. occ. circa thermas *les Eaux Bonnes* et *les Eaux Chaudes* dictas. P. c. circa *B. de Luchon*, locis *Esquierry* et *Lac de Séculéjo**.

58. *Anæctangium*, Schwaegr.

305. *A. compactum*, Schwgr. Suppl. t. 11; Br. Europ. *Anæctangium*, p. 5. t. 1; M. P. 241.

Hab. Z_2 P. c. ad rupes irroratas circa *Bagnères-de-Luchon*, locis *Lac de Séculéjo*, *Cascade du Cœur* et *Superbagnères*: plerumque fertile.

Tribus 24. ZYGODONTÆ, Bryol. Europ.

59. *Zygodon*, Hooker et Taylor.

306. *Z. Mougeotii*, B. et S. ! Br. Europ. fasc. 4. p. 7. t. 1; M. P. 242.

* In the Supplement to the 1st volume of Bridel's 'Bryologia Universa' the two following gymnostomous mosses are described, and said to grow near Dax:—

"*Gymnostomum homomallum*, Brid.; caule erecto simplicissimo, foliis lanceolatis acutis integerrimis supremis e nervo crasso excurrente longissime subulatis secundis, thecæ oblongæ operculo conico-rostrato incurviusculo.

"Circa *Dax* ad terram cæspitosam legit D. Grateloup; clar. Candolleus communicavit.

"A *Didymodonte homomallo*, quem habitu proxime refert dignoscitur statura duplo minore, caule simplicissimo, foliorum supremorum longitudine et areolatione, præprimis stomate nudo."—Br. Univ. 1. p. 757.

May not this be *Trichostomum subulatum*, Bruch, with which it agrees well enough except as to the peristome, which may have been overlooked?

"ENTOSTHYMENIUM, Brid.

"*Character essentialis*. Stoma externe nudum; interne membrana angusta annulari margine tandem lacinulata instructum. Calyptra cuculliformis. Theca subinæqualis, apophysata.

"*E. tristichum*, Brid.; caule erecto ramosiusculo, foliis patentibus sicciatate incurvis subtristichis ovato-lanceolatis acutiusculis solidinerviis, thecæ ovate subinclinatæ apophysi basilari parva.

"In Gallia australi circa *Dax* D. Grateloup detexit; Candolleus communicavit. Cæspitibus fastigiatis vivit.

"*Barbulum* e toto habitu, foliorumque forma et areolatione diceret, at membrana annularis et apophysis proprium genus declarant."—Br. Univ. 1. p. 761.

I confess myself unable to form a probable guess as to what this moss really is: the possessors of the Bridelian herbarium must decide.

Hab. Z_{1-2} per Pyrenæos sylvaticos, rupestris, frequens sed rarissime fructificans; juxta lacum *Séculéjo* capsulis deoperculatis, 22 Sept. 1845, legi.

307. *Z. viridissimus*, Smith, Fl. Brit. p. 1224 (sub *Dicrano*); Br. Europ. l. c. p. 7. t. 1; M. P. 243.

Hab. Z_1 ad arbores circa *Pau* et *Bagnères*, plerumque sterilis.

308. *Z. conoideus*, Schwgr. Suppl. 2. p. 138. t. 137; Br. Europ. l. c. p. 8. t. 2.

Hab. Z_1 P. c. in truncis populi vetustis juxta pagum *Pouzac*! (Philippe!). *Estafforte*, *Hte. Garonne* (Brondeau in hb. Dufour).

In these specimens the leaves are often nerved throughout, and the nerve even excurrent into a short mucro. The sporular sac rises above the mouth of the capsule before it is divided into cilia, which are two cellules in breadth near the base, sometimes sixteen in number, the intercalary cilia being far shorter than the others.

Tribus 25. PTYCHOMITRIÆ.

60. *Ptychomitrium*, Bryol. Europ.

309. *P. polyphyllum*, Dicks. Crypt. fasc. 3. p. 7 (sub *Bryo*); Br. Europ. *Ptychom.* p. 4. t. 1; M. P. 244.

Hab. Z_{1-3} in saxis graniticis regionum sylvaticarum: e vulgarissimis.

310. *P. incurvum*, Muehl. Cat. Plant. Amer. Sept. p. 98 (sub *Grimmia*). *Weisia incurva*, Schwgr. Suppl. 2. p. 51. t. 116. *Grimmia Muehlenbergii*, Brid. Br. Univ. 1. p. 181. *Ptychomitrium pusillum*, B. et S.! Br. Europ. *Ptychom.* p. 5. t. 1; Sullivant! Musci Allegh. n. 135.

Hab. Z_1 P. occ. in muro prope *Oloron*. Cæspitem unicum inveni.

Leaves composed of two layers of cellules except near the base; the margins often thickened (= 2 cellules); the nerve = 3-5 cellules; the obtuse apex cucullate.

Tribus 26. ORTHOTRICHACÆ, Bryol. Europ. (ex parte).

61. *Orthotrichum*, Hedwig.

Obs. This genus includes but few rupestral species, and only two of these (*O. anomalum* and *cupulatum*) have their normal station on calcareous rock. Of the species which inhabit the bark of trees, it is remarkable that those with an exserted capsule (*Ulota*, Bridel) prefer young oaks, while those with an immersed capsule prefer poplars.

§ 1. (= *ULOTA*, Bridel.)

311. *O. crispulum*, Bruch. Mst. in Brid. Br. Univ. 1. p. 793; Br. Europ.! *Orthotrichum*, p. 23. t. 12; M. P. 245.

Hab. $Z_{1\text{ inf.}}$ ad arbores in sylvis Pyren. occidentaliū, locis *Jurançon*, *Gan*, &c.

312. *O. crispum*, Hedw. Musc. Frond. 2. t. 35 ; Br. Europ. ! *l. c.* p. 23. t. 12 ; M. P. 246.

Hab. Z_{1-2} ad arborum truncos. In monte *Lhieris* peristomio interno 16-ciliato occurrit.

313. *O. Bruchii*, Brid. Br. Univ. 1. p. 744 (sub *Ulota*). *O. coarctatum*, Br. Europ. *l. c.* p. 21. t. 11 (non P. Beauv.).

Hab. Z_1 P. occ. ad arborum truncos in valle d' *Ossau* prope *Gan*, rarissime !

314. *O. Hutchinsiae*, Smith, E. Bot. t. 2523 ; H. et T. ! Musc. Brit. p. 131. t. 21 ; Br. Europ. *l. c.* t. 10 ; M. P. 247.

Hab. $Z_{1\text{ sup.}}$ ad saxa granitica per Pyrenæos occidentales, in vicinia *Cauterets* et *Pierrefitte* præcipue.

315. *O. coarctatum*, Pal. Beauv. Prodr. p. 80. *O. Ludwigii*, Schwgr. Suppl. t. 51 ; Grev. ! Scot. Cr. Fl. t. 133 ; Br. Europ. *l. c.* t. 4 ; M. P. 248.

Hab. Z_{1-2} P. occ. et c. ad fruticem ramulos, frequens. *Mte. Verte* ; *V. du Lys* ; *Labassère*, &c.

316. *O. anomalum*, Hedw. Musc. Frond. 2. t. 37 ; Br. Europ. p. 10. t. 3 ; M. P. 249.

Hab. Z_1 in saxis calcareis ; in arborum truncis ad viam quæ ducit a pago *Loudervielle* ad *Port de Peyresourde* in Pyr. centralibus.

§ 2. (= *ORTHOTRICHUM*, Bridel.)

317. *O. leiocarpum*, B. et S. Br. Europ. *l. c.* p. 28. t. 15 ; M. P. 250. *O. striatum*, Schwgr. Suppl. t. 54 (vix Hedwigii) ; H. et T. Musc. Brit. ! p. 128. t. 21.

Hab. Z_1 ad arborum corticem, frequens.

318. *O. Lyellii*, Hook. et Tayl. ! Musc. Brit. p. 76. t. 22 ; Br. Europ. *l. c.* p. 27. t. 16.

Hab. Z_1 in arboribus, rarius. P. occ. *V. d' Ossau*. P. c. *B.-de-Bigorre*.

319. *O. diaphanum*, Schrad. Spicil. Fl. Germ. p. 69 ; Br. Europ. *l. c.* t. 14 ; M. P. 251.

Hab. Z_{0-1} ad arbores præcipue populos.

320. *O. patens*, Bruch in Brid. ; Br. Europ. ! *l. c.* p. 17. t. 7.

Hab. $Z_{1-\text{inf.}}$ ad populorum truncos, rarissimum. P. occ. *Pau* ; *Jurançon*. P. c. *B.-de-Bigorre* (Philippe !).

321. *O. stramineum*, Hsch. ; Brid. Br. Univ. 1. p. 789 ; Br. Europ. ! *l. c.* p. 23. t. 13 ; M. P. 252.

Hab. Z_{0-2} ad truncos, vulgatissimum. *Oloron* ; *Cauterets* ; *V. de Campan*, &c.

“ Var. 2, collo capsulæ longioris sporangium æquante, ciliis 8, vaginula vix pilosa ; ” M. P. 253.—*Hab.* ad populorum truncos in valle d' *Ossau* prope *Louvie*.

I am not certain that the authors of 'Bryol. Europ.' would not refer this to their *O. fastigiatum* (l. c. t. 8) : the vaginula is however always slightly hairy.

322. *O. pallens*, Bruch in Brid. Br. Univ. 1. p. 788 ; Br. Europ. l. c. p. 24. t. 13. "*O. stramineum*, var. 3. foliis capsulisque tenerioribus, vaginula nuda, ciliis semper 16 ;" M. P. 254.

Hab. Z₁ P. occ. ad arbores campestris prope *Louvie et Caute-
rets*.

323. *O. speciosum*, Nees in Sturm. Deut. Fl. Crypt. hft. 16 ; Br. Europ. ! l. c. p. 19. t. 9 ; M. P. 255.

Hab. Z₁ ad frutices in sepibus, rarissimum. P. occ. *Luz.* P. c. *Vallée d'Aure* ; *B.-de-Bigorre* (Philippe !).

324. *O. affine*, Schrad. Spicil. Fl. Germ. p. 67 ; Br. Europ. l. c. p. 17. t. 7 ; M. P. 256.

Hab. Z₀₋₂ ad arborum truncos.

325. *O. tenellum*, Bruch in Brid. Br. Univ. 1. p. 786 ; Br. Europ. ! l. c. t. 6 ; M. P. 257.

Hab. Z₀₋₁ ad arborum truncos. P. occ. *St. Sever* ; *Pau.* P. c. *B.-de-Bigorre*.

Var. capsula *emersa*, subclavata ; calyptra *magna*, capsulam totam obtegente, straminea.—*Hab.* prope *St. Sever*.

326. *O. pumilum*, Schwgr. Suppl. t. 50 ; Br. Europ. ! l. c. p. 14. t. 5 ; M. P. 258.

Hab. Z_{1 inf.} P. occ. et c. ad populos prope *Pau* et *B.-de-Bigorre*.

327. *O. rupestre*, Schleich. ; Schwgr. Suppl. t. 53 ; Br. Europ. ! l. c. p. 19. t. 9 ; M. P. 259. *O. rupicola*, Funck. ; Grev. ! Scot. Cr. Fl. t. 105.

Hab. Z₁₋₂ in saxis præsertim graniticis, frequens. *Les Eaux Chaudes* ; *Pierrefitte* ; *V. du Lys*, &c. In arborum cortice supra *Cauterets*.

328. *O. urnigerum*, Myrin Cor. Flor. Upsal. p. 71 ; Br. Europ. ! l. c. p. 29. t. 17 ; M. P. 260.

Hab. Z₁ in arboribus et saxis graniticis prope *Pierrefitte* et *Cauterets*, socio *Leskea nervosa* : rarissime.

329. *O. Sturmii*, H. et H. Bot. Zeit. 1819, p. 89 ; Br. Europ. l. c. p. 9. t. 2.

Hab. P. or. *St. Martin du Canigou* et in convalle d'*Eynes* (Montagne, l. c.).

330. *O. cupulatum*, Hoffm. Deutsch. Flor. 2. p. 26 ; Br. Europ. l. c. t. 2 ; M. P. 261.

Hab. Z₁ in saxis calcareis, haud vulgatum. *Les Eaux Bonnes*, &c.

331. *O. obtusifolium*, Schrad. Crypt. Germ. p. 14; Br. Europ. l. c. p. 13. t. 1; M. P. 262.

Hab. Z_1 inf. P. occ. et c. circa Pau et B.-de-Bigorre in populorum truncis.

Tribus 27. ENCALYPTEÆ, Bryol. Europ.

62. *Encalypta*, Schreber.

332. *E. streptocarpa*, Hedw. Sp. Musc. t. 10; Br. Europ. fasc. 4. p. 15. t. 7; M. P. 295.

Hab. Z_1 in calce arenato murorum et ad terram calcaream in sylvis omnium Pyrenæorum, plerumque fertilis. *Forêt de Lhieris*; *Les Eaux Bonnes*, &c.

333. *E. rhabdocarpa*, Schwgr. Suppl. t. 17; Br. Europ. l. c. p. 13. t. 6; M. P. 296.

Hab. Z_{3-5} in rupibus schistosis, rarissime. P. occ. *V. de Combascou*, ut et in summo montium jugo loco *Port de Cauterets*. P. c. *Lac Lehou*.

334. *E. ciliata*, Hedw. Sp. Musc. p. 61; Br. Europ. l. c. p. 10. t. 3; M. P. 297.

Hab. Z_2 in rupibus umbrosis, ad viarum latera, &c. passim.

335. *E. vulgaris*, Hedw. Sp. Musc. p. 60; Br. Europ. l. c. p. 9. t. 2.

Var. β . *gymnostoma*, Br. Europ.—*Hab.* Z_1 in solo calcareo prope *Les Eaux Chaudes*, rarissime.

Var. γ . *mutica*, Brid. et Br. Europ.; M. P. 298.—*Hab.* ad viarum latera prope *Gavarnie*.

Var. ϵ . Br. Europ. (= *E. pilifera*, Funk).—*Hab.* *Forêt de Transoubât*, socio *Grimmia anodonte* (Philippe!).

336. *E. commutata*, N. et H. Br. Germ. 2. t. 15; Br. Europ. l. c. p. 8. t. 1; M. P. 299.

Hab. Z_{2-4} in terra denudata rupium. P. occ. *Mt. Lizé*. P. c. *Gavarnie*; *Lac Lehou*; *Lac de Séculéjo*.

337. *E. ? ligulata*, Spruce in Musci Pyr. n. 331: dense cæspitosa; caule erecto, simplici dichotomove, tenui, *fragili*; foliis confertis, e basi suberecta patulo-subreflexis, *lineari-spatulatis*, *obtusis*, *acute carinatis*, margine inferiori recurvis, *nervo paulo ante apicem evanido*, areolatione præter ad basin (ubi laxiori) minutissima, obscura.

Hab. Z_1 sup. in rupibus humidis præsertim ophiticis, locis *Labbassère*, *Superbagnères* et *Gorge de Cauterets*.

Planta tota tenerrima, $\frac{1}{4}$ –1 unc. longitudine. *Caulis* dense foliosus et inter folia radiculis propriis pallidis tenuissimis ramosis *flexuosis* vestitus. *Folia* lurido-rufescentia, chlorophyllo destituta, terminalibus pallido-viridibus chlorophyllosis exceptis, hic illic confertiora majora

subcomantia, e basi angusta sensim et usque ad $\frac{4}{5}$ folii latiora, longitudine tota = 4-5 latitudinem ubi latissima, apice ipso rotundato-obtusa, *carinata, inferne complicata*, superne subexplanata; *cellulæ omnes subparallelogrammæ, parietibus crassis, inferiores magnæ* longitudine = 2 lat., *superiores 4-6ies breviores subæquilateræ, versuum 3-4 marginalium crassiores et ex eo folia inferiora rufo-marginata, superiora pallido-marginata.*

Tribus 28. HEDWIGIACEÆ, Bryol. Europ.

63. *Hedwigia*, Ehrhart.

338. *H. imberbis*, Smith, E. Bot. t. 2237 (sub *Gymnostomo*); M. P. 263. *Hedwigidium imberbe*, Br. Europ. p. 3. t. 1.

Hab. Z₁ P. occ. ad saxa granitica prope *Laruns*. P. c. in rupibus schistosis prope *Pouzac* et *Gazos* (Philippe!).

339. *H. ciliata*, Hedw. Musc. Frond. 1. t. 40; Br. Europ. *Hedwigia*, p. 5. t. 1, 2; M. P. 264.

Hab. Z₁₋₄ in saxosis, ubique vulgata. "*Pic du Midi vers 2600 mètres d'altitude*" (Desmoulins).

Tribus 29. GRIMMIACEÆ, Bryol. Europ.

64. *Schistidium*, Bridel (ex parte).

340. *S. apocarpum*, L. Sp. Pl. p. 1579 (sub *Bryo*); Br. Europ. ! p. 7. t. 3, 4; M. P. 265.

Hab. Z₀₋₅ in saxis, passim.

341. *S. confertum*, Funk, Moos-Tasch. t. 12 (sub *Grimmia*); Br. Europ. l. c. p. 7. t. 2. *S. apocarpum* var. *confertum*, M. P. 266.

Hab. Z₁₋₅ P. c. in rupibus humidiusculis graniticis et argillaceo-schistosis. *Vallée de Castelloubon. Port de Bénasque!* (Arnott!). *B.-de-Bigorre* et *Labassère* (Philippe!).

† *S. ? recurvifolium*, Wils. in litt. ad R. S.

Hab. Z_{1 sup.} P. occ. in rupibus argillaceo-schistosis vallis d' *Ossau* supra *Béost*, sterile.

This moss has been found in a barren state in several parts of England. It approaches very closely to *S. apocarpum*, yet it may be a *Tortula* or a *Didymodon*.

65. *Coscinodon*, Sprengel.

342. *C. cribrosus*, Hedw. Musc. Frond. 3. t. 31 (sub *Grimmia*); M. P. 267. *Coscinodon pulvinatus*, Spreng.; Br. Europ. *Coscinodon* (cum ic.).

Hab. Z₁₋₂ P. occ. in rupibus schistaceis prope *Pierrefitte*. P. c. locis similibus vallis *Castelloubon* loco *les Sciéries de Gazos*, etiam in mortario murorum ad pagum *Asté*, ubi am. Philippe detexit. P. or. locis *Bellegarde* et *Concampa* (Arnott!).

"Folia nonnunquam *trinervia*, i. e. plicis lateralibus e strato duplici cellularum constitutis." M. P. l. c.

On the mountain (*Superbagnères*) which rises at the back of the town of *Bagnères-de-Luchon*, I gathered a *Coscinodon*, which differs considerably in the foliage from my specimens of *C. cribrus*, but the fruit is too immature to afford any character. The leaves are smaller, *erect at the base, then widely spreading, and finally incurved at the summit*, strongly keeled, but *quite destitute of plicæ: those of the perichætium remarkably large*, three times the length of the stem-leaves.

66. *Grimmia*, Ehrhart.

Obs. The species of this genus are in the Pyrenees perhaps more conspicuous than those of any other. *G. orbicularis* and *crinita* were observed only on calcareous formations, and the latter only on mortar in walls: both in exposed sunny situations*, not rising to the region of coniferous trees. *G. sulcata* was noticed only on argillaceous schist. The only species which never descend into the woody region are *G. sulcata* and *atrata*. The following species are subalpine or alpine: *G. patens*, *elatiior*, *funalis*, *spiralis*, *incurva*, *Doniana*, *alpestris* and *ovata*; but nearly all of these are occasionally seen below the coniferous region, or towards the upper limit of Z_1 . The following species are characteristic of the lower mountains, namely *G. leucophæa* on granite or schist, and *G. orbicularis* on limestone. The region of coniferous trees (Z_2 , Z_3) is marked by the frequent occurrence of *G. ovata*, *commutata* and *elatiior*. The essentially alpine species (above-mentioned) are too sparingly distributed to impart any peculiarity to the vegetation.

343. *G. anodon*, Br. Europ. *Grimmia*, p. 8. t. 1.

Hab. Z_2 P. c. *V. du Lys* in saxis graniticis; in rupibus micaeo-schistosis sylvæ *Transoubât* supra *Oubat* (Philippe!).

344. *G. crinita*, Brid. Mant. p. 32; Br. Europ. ! l. c. p. 10. t. 2; M. P. 268.

Hab. Z_{0-1} P. occ. in muris prope *Pau*. P. c. ad casarum muros in pago *Pouzac* prope *B.-de-Bigorre* ! (Philippe!).

Specimens communicated by Dr. Arnott from Montpellier have the perichætial leaves alone piliferous, even the terminal ones of the sterile branches being muticous. In this character it precisely agrees with *G. plagiopodia*, Hedw.; yet the calyptra is dimidiate, not mitriform as in that species.

345. *G. pulvinata*, L. Sp. Pl. p. 1586 (sub *Bryo*); Br. Europ. l. c. p. 12. t. 4; M. P. 269.

Hab. Z_{0-1} in muris rupibusque umbrosioribus.

346. *G. orbicularis*, B. et S. ! Br. Europ. l. c. p. 13. t. 5; Wil-

* In the Eastern Pyrenees, Dr. Arnott observed walls covered on the south side with *G. orbicularis*, and on the north side with *G. pulvinata*.

son ! in E. Bot. Suppl. t. 2888 ; M. P. 270. *G. africana*, Arnott ! Disp. Meth. p. 21 ; Duby, Bot. Gall. p. 574.

Hab. Z_{0-1} in muris rupibusque calcareis apricis circa Pau et B.-de-Bigorre. *Pyrénées Orientales* (Arnott !). Circa Burdigalam (Grateloup !).

347. *G. spiralis*, H. et T. in Drumm. Musc. Scot. v. 2. n. 29; Grev. ! Scot. Cr. Fl. t. 203; Br. Europ. l. c. p. 14. t. 7; M. P. 271.

Hab. Z_{2-4} P. occ. in saxis graniticis circa *Cauterets*, locis *Mt. Lizé*, *Source de la Raillère* et *Lac de Gaube*, pulcherrime ! P. c. *Lac Lehou* (Philippe !). P. or. *V. d'Eynes* (Arnott !).

348. *G. torta*, H. et Nees, Br. Germ. 2. t. 22. *G. torquata*, Hook.; Grev. ! Scot. Cr. Fl. t. 199. *G. spiralis* var. *torta*, M. P. 272.

Hab. Z_{2-3} in rupibus udiusculis. P. occ. secus rivuli *Gave de Marcadaou* ripas, socio *Zygodonte Mougeotii*. P. c. *Lac de Séculéjo*.

Zygodon species vult cel. Schimper.

349. *G. incurva*, Schwgr. Suppl. 1. § 1. p. 9 ; § 2. t. 97. "*G. trichophylla*," M. P. 273.

Hab. Z_{1-2} P. occ. in saxis graniticis vallis *Combascou*, ut et prope *Pierrefitte*.

350. *G. trichophylla*, Grev. Scot. Cr. Fl. t. 100 ; Br. Europ. *Grimmia*, p. 16. t. 9.

Hab. P. or. ad *St. Antoine de Galamus* in montibus *Corbariis* (Montagne, l. c.).

351. *G. funalis*, Schwgr. Suppl. 1. § 1. p. 150. t. 37 (sub *Trichostomo*) ; Br. Europ. *Grimmia*, p. 17. t. 11.

Hab. Z_1 sup. P. c. in rupibus argillaceo-schistosis, locis *Labassère* et *V. de Castelloubon*.

352. *G. elatior*, B. et S. ! Br. Europ. l. c. p. 17. t. 10 ; M. P. 274.

Hab. Z_{2-3} in saxis graniticis secus rivulos *Pyrenæorum* totorum, sed nusquam copiosa. *Cauterets*. *Penticosa*. *Ruisseau d'Ardalos*, &c. *Mont Louis* et *Seo d'Urgel* (Arnott !). In summo monte *Canigou* (Montagne !).

353. *G. patens*, Dicks. Crypt. fasc. 2. p. 6 (sub *Bryo*) ; Br. Europ. l. c. p. 18. t. 10 bis.

Hab. Z_{2-4} ad rupes madidas regionum sylvaticarum alpinarumque. *Pont d'Espagne*. *Port de Cauterets*, &c.

354. *G. commutata*, Hueben. Musc. Germ. p. 185 ; Br. Europ. ! l. c. p. 25. t. 19 ; M. P. 276. *Dicranum ovale*, Hedw. Sp. Musc. p. 140.

Hab. Z_{2-3} in rupibus graniticis secus rivulos. *Gave d'Ossau. Pont d'Espagne. Penticosa. Mont Louis* (Arnott!).

355. *G. leucophæa*, Grev. ! Act. Soc. Wern. 4. t. 6; Br. Europ. *l. c.* p. 23. t. 20; M. P. 277.

Hab. Z_1 in saxis graniticis schistosisque montium humiliorum, frequens. *Cauterets. B.-de-Bigorre. Seo d'Urgel* (Arnott!). In tepidariis *Vernet les bains* (Montagne!).

356. *G. ovata*, W. et M. Iter Suec. t. 2; Br. Europ. ! *l. c.* p. 21. t. 17; M. P. 278.

Hab. Z_1 sup.—3 in saxis graniticis Pyrenæorum totorum sylvaticorum.

Var. δ . *cylindrica*, Br. Europ. *l. c.* t. 18; M. P. 279. *G. cylindrica*, Br. Germ. *Hab.* ad lacus Séculéjo ripas.

357. *G. Doniana*, Smith, Fl. Brit. p. 1198; H. et T. ! Musc. Brit. p. 72. t. 13; M. P. 280. *G. obtusa*, Schwgr.; Br. Europ. *l. c.* p. 20. t. 13.

Hab. Z_{2-3} P. c. in saxis graniticis vallis *Castelloubon*, loco *les Scieries de Gazos; Vallon du Peyrosse* (Philippe!); *Mt. Maladetta* (DeC. in Fl. Française).

Var. *curvula*, M. P. 281. *Grimmia curvula*, Br. Europ. *l. c.* p. 11. t. 3. *Hab.* *V. de Castelloubon*, cum forma normali; *Gorge de Labassère; Port de Bénasque* (Arnott!).

“Pedicellus in statu etiam normali *curvulus* est;” M. P. *l. c.*

358. *G. alpestris*, Schleich. Pl. exsic. Helvet.; Br. Europ. ! *l. c.* p. 27. t. 15; M. P. 282.

Hab. Z_3 P. occ. circa *Cauterets*, in saxis graniticis ad marginem lacus *Lac de Gaube* dicti, etiam in monte *Lizé* et secus ripas *Gave de Marcadaou*. P. c. *derrière le Pic Montaigu à côté de Gazos* (Philippe!). P. or. *Mt. Canigou* (Arnott!).

359. *G. sulcata*, Sauter, Br. Europ. ! *l. c.* p. 27. t. 16; M. P. 283.

Hab. Z_4 in rupibus udis argillaceo-schistosis loco *Port de Bénasque*. In summis Pyrenæis sine loco designato (Endress in Br. Europ.).

Folia in parte superiore e serie duplici triplicive cellularum constituta.

360. *G. atrata*, Mielich. Bot. Zeit. 1819, p. 85; Br. Europ. ! *l. c.* p. 30. t. 24; M. P. 284.

Hab. Z_4 P. c. in rupium schistosarum fissuris ad marginem lacus dict. *Lac Lehou; Pic de la Peyre* (Philippe!); *Port de Bénasque* (Arnott!). P. or. *Pic de Crabère* (Arnott!).

67. *Racomitrium*, Bridel.

361. *R. fasciculare*, Schrad. Spicil. Fl. Germ. p. 61 (sub *Trichostomo*); Br. Europ. *Racomitrium*, p. 8. t. 4; M. P. 285.

Hab. Z_{2-3} in rupibus udis regionis arborum conifer., frequens. *Pont d'Espagne.* *V. de Lesponne*, &c.

362. *R. lanuginosum*, Hedw. Musc. Frond. 3. p. 3. t. 2 (sub *Trichostomo*); Br. Europ. *l. c.* p. 11. t. 6.

Hab. Z_{1-2} per Pyrenæos, fere semper sterile, fertile tamen juxta les *Eaux Bonnes* legit am. Southby.

According to the 'Bryologia Europæa' this species is never fertile in the plains, but in England I have gathered well-fruited specimens on moors in the vale of York, at an elevation of not more than 50 feet above the sea.

363. *R. canescens*, Hedw. Musc. Frond. 3. t. 3 (sub *Trichostomo*); Br. Europ. *l. c.* p. 12. t. 7; M. P. 286.

Hab. Z_{1-2} in sylvis terrestre et rupestre, haud raro fertile.

364. *R. sudeticum*, Funk. Crypt. n. 670 (sub *Trichost.*); Br. Europ. ! *l. c.* p. 7. t. 1; M. P. 287. *Trichostomum microcarpon*, Hedw.; H. et T. ! Musc. Brit. p. 107. t. 19.

Hab. Z_{2-4} in rupibus graniticis schistosisque humidiusculis. P. c. *V. de Castelloubon*; *Ruisseau d'Ardalos*; *Route du Lac Lehou* (Dufour !); *Base du Pic du Midi* (Philippe !). P. or. *Cambrédazes* (Arnott !).

Var. minus, habitu *Grimmiæ ovatæ*; foliis plerumque muticis; *dentibus peristomii* 16 *subintegris bifidisve*, nunquam usque ad basin partitis. *Hab.* in loco alpino *Port de Bénasque* dicto.

The teeth of the peristome are united at the base into a membrane rising above the mouth of the capsule, by which this variety is distinguished from *Grimmia ovata*. The basal cellules of the leaf have three or four marked indentations on each side, and the margins are slightly incrassated upwards.

365. *R. heterostichum*, Hedw. Musc. Frond. 2. t. 25 (sub *Trichostomo*); Br. Europ. *l. c.* p. 9. t. 2 *bis* et 3; M. P. 288.

Hab. $Z_{1 \text{ sup.}-3}$ in saxis rupibusque, vulgatissimum.

366. *R. protensum*, Al. Braun; Br. Europ. *l. c.* p. 6, t. *Drypt.* 2; M. P. 289. *Dicranum aciculare* γ, Turn. ! Musc. Hibern. p. 67.

Hab. Z_2 in rupibus udis secus rivulos. P. occ. *Mte. Verte.* P. c. *Labassère*; *V. de Castelloubon*; *Forêt de Transoubât*.

367. *R. aciculare*, Hedw. Musc. Frond. 3. t. 33 (sub *Dicrano*); Br. Europ. *l. c.* p. 6, t. *Drypt.* 1; M. P. 290.

Hab. Z_2 in saxis rivulorum, frequens.

Tribus 30. RIPARIACEÆ, Bryol. Europ.

68. *Cinclidotus*, Pal. Beauv.

368. *C. riparius*, W. et M. Bot. T. p. 120 (sub *Trichostomo*); Br. Europ. ! *Cinclidotus*, p. 10. t. 2; M. P. 291.

Hab. Z₁₋₂ P. occ. et c. (*forma typica*) in rivulo *Gave d'Ossau* dicto prope *Gabas*.

Var. *β. terrestris*, Br. Europ. ! l. c. p. 11. t. 2; M. P. 292.—

Hab. ad saxa arborumque radices prope *Narcastet* et *Jurançon*. *Montgaillard*, secus ripas fl. *Adour* (Philippe!).

369. *C. fontinaloides*, Hedw. Musc. Frond. 3. t. 14 (sub *Trichostomo*); Br. Europ. l. c. p. . t. 3; M. P. 293.

Hab. Z₁₋₂ in saxis demersis rivulorum.

370. *C. aquaticus*, Hedw. Musc. Frond. 3. t. 11 (sub *Hedwigia*); Br. Europ. ! l. c. p. 8. t. 1; M. P. 294.

Hab. Z₁ P. c. prope *B.-de-Bigorre*, in flum. *Adour* ut et in rivulo juxta monasterium *Médous*, saxis demersis adhærens: planta ♂ sola. *Rivière du Hérault*, *Vaucluse* (Arnott!).

Tribus 31. FONTINALEÆ, Bryol. Europ.

69. *Fontinalis*, Dillenius, Linnæus.

371. *F. antipyretica*, L. Sp. Pl. p. 1571; Br. Europ. *Fontinalis*, t. 2.

Hab. Z₁ in aquis fluentibus Pyrenæorum, haud vulgaris. P. occ. prope *les Eaux Bonnes* (Dufour!) etiam juxta pagum *Bétharam* pulchre fructiferum (*Grateloup*!).

Tribus 32. FISSIDENTEÆ, Bryol. Europ.

70. *Fissidens*, Hedwig.

372. *F. grandifrons*, Brid. Suppl. Musc. 1. p. 170 (1806); Br. Europ. fasc. 17, *Fissidens*, p. 11. t. 6; M. P. 311. *Dicranum adiantoides β. atrovirens*, DeCand. Fl. Fr. *D. palmiforme*, Ramond, Pyr. ined. (1815).

Hab. Z₁ per totos Pyrenæos in rupibus tophaceis irroratis, præcipue secus cataractas: semper sterilem vidi. Prope *B.-de-Bigorre*, in vallecula *Elysée Cottin* dicta, floribus masculis detexerunt Philippe et R. S.

Flores masculi medio caule positi, in foliorum duplicatura nidulantes, raro proxime sequentes foliis caulinis autem 2-3 inanibus inter singula folia florigera, iis *F. adiantoidis* similes, 5-8-phylli. *Folia floralia* propria 2-3, ovata, concava, dorso haud alata apice tamen laminula parva (= $\frac{1}{4}$ folii) instructa. *Antheridia* 4-9, oblongo-cylindrica, paraphysibus destituta.

373. *F. adiantoides*, L. Sp. Pl. p. 1588 (sub *Hypno*) ; Br. Europ. l. c. p. 10. t. 5 ; M. P. 312.

Hab. Z_{1-3} in scaturiginosis pratisque humidis, frequens.

374. *F. taxifolius*, L. Sp. Pl. p. 1587 (sub *Hypno*) ; Br. Europ. l. c. p. 9. t. 4 ; M. P. 313.

Hab. Z_{0-1} in sylvaticis, terrestribus.

375. *F. osmundioides*, Hedw. Sp. Musc. t. 40 ; Br. Europ. l. c. p. 8. t. 3 ; M. P. 314.

Hab. Z_2 P. c. in saxibus irroratis cataractæ dict. *Cascade du Cœur*.

376. *F. incurvus*, Schwgr. Suppl. t. 49 ; Br. Europ. ! l. c. p. 6. t. 1 ; M. P. 315.

Hab. $Z_{1\text{ inf}}$ P. c. in terra arenosa. P. occ. prope Géllos. P. c. prope B.-de-Bigorre.

Along with the usual state of the species at Géllos grows a delicate form which I am undecided whether or not to regard as a distinct species. It has the calyptra conico-subulate, *quite entire, barely sheathing the operculum*. The antheridia are enclosed in a bud springing from the base of the stem, precisely as in *F. taxifolius* : I have not seen one terminating a branch, as in *F. incurvus*.

377. *F. fontanus*, Schimper ; M. P. 316. *F. incurvus* var. *fontanus*, Br. Europ. l. c. t. 1. f. β . 1.

Hab. Z_1 ad saxa emersa rivuli *Adour de Lesponne* prope B.-de-Bigorre.

378. *F. bryoides*, Hedw. Musc. Frond. 3. t. 29 ; Br. Europ. l. c. t. 2 ; M. P. 317.

Hab. Z_{0-1} ad terram arenosam et argillaceo-arenosam.

"Var. *rivularis*, foliis 12–20 jugis, *elongatis, limbo valde incrassato circumductis*, capsula plerumque horizontali ;" M. P. 318.—*Hab.* B.-de-Bigorre in lapidibus rivuli supra fontem *la fontaine ferrugineuse* dictum.—An species propria ? (*F. Pyrenaicus*, mst.)

71. *Conomitrium*, Montagne.

379. *C. Julianum*, Savi, Poll. Fl. Veron. 3. p. 385 (sub *Fontinali*) ; Mont. in Ann. des Sc. nat. tom. 8. p. 250. t. 4. *Octodicerus Julianum*, Brid. Br. Univ. 2. p. 678 ; Br. Europ. fasc. 17 (cum icone).

Hab. Z_0 P. occ. *Dax*, in fontibus tepidis (Dufour ! Grateloup !).

Tribus 33. LEUCOBRYACEÆ, C. Muell. Syn. Musc.

72. *Leucobryum*, Hampe in Linnæa, 13. p. 42.

380. *L. glaucum*, L. Sp. Pl. p. 1582 (sub *Bryo*) ; C. M. Syn. Musc. p. 74. *Dicranum glaucum*, Hedw. ; Schwgr. Suppl. t. 48 ; M. P. 204.

Hab. Z_{0-1} in sylvis Pyrenæorum humiliorum ut et Agri
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Syrfici, truncos Castanearum decurtatarum cariosos pulcherrime vestiens.

Nothing can exceed the beauty of this moss when in a state of luxuriant fructification, as it is seen in the forests at the foot of the French Pyrenees. There it spreads over fallen timber and the decaying trunks of polled chestnut-trees, and the rich brown capsules, each half-enveloped in its silvery calyptra, stud its swelling and snowy tufts as with so many gems. The structure of its leaves is very remarkable and appears not to have been well understood by bryologists. I consider the leaves to be as *truly nerved* as those of *Dicranum longifolium*, *Campylopus fragilis*, e. a., where the existence of a nerve is now generally admitted. The nerve, in fact, occupies nearly the whole of the leaf, with the exception of a narrow limb on each side, of one cellule in thickness and 10 or 12 cellules in breadth near the base, which disappears about half-way up the leaf, or a little beyond where the margins begin to be strongly inflexed: this is quite analogous to what is observed in the species just referred to. [See PLATE I., where figures 1 and 2 represent transverse sections of the leaf, the former made near the apex and the latter near the base; *a b* the nerve, *a a* and *b b* the limb on each side: magnified about 240 times.] The nerve consists of only two layers of cellules, towards the apex, and on the axis down to the very base; but in its lower half one or two additional layers are imposed on both the upper and under surfaces, the greatest thickness being about midway between the axis and the limb on each side (fig. 2), in consequence of which the leaf is usually somewhat channeled on the back towards the base. The cellules composing the nerve are elongated prisms, quadrangular on the longitudinal and 5-7-gonal on the transverse section. Their *internal* walls exhibit large circular perforations (see figs.), one in each end and 1-3 in each side of every cellule. I have been unable to detect any openings whatever in the *external* walls of those cellules which constitute the upper and under surfaces of the nerve; the foramina, which appear in great numbers on regarding a leaf with a tolerably high power, being proved, by accurately adjusting the lens, and especially by cutting various sections of the leaf, to belong, *not to the external surface*, but to the walls separating contiguous cellules; so that, while there is ample provision for a *free communication between the cellules of the nerve*, there is none whatever for their communicating with the external medium, or at least none but what exists in all cellular tissue, which is at variance with what we observe in the genus *Sphagnum*, to which *Leucobryum* is often (and not inaptly) compared, as to its mode of growth and general aspect*. In the cellules of the limb I have been unable to detect either external or internal perforations. A transverse section is seen to be traversed by a tolerably regular medial line, which indicates the junction of the two principal layers of cellules, and is marked by

* It is worthy of remark, that the cellules of some *Sphagna*, e. g. *S. cymbifolium*, communicate laterally with each other by means of pores in the adjacent walls.

a series of *lozenge-shaped openings* at the cellular angles. These openings are the sections of *slender chlorophyllose cellules, running in lines from the base to the apex of the leaf*, and having no communication by pores with the perforated tissue in which they are interposed. [See fig. 3, which represents part of a longitudinal section through one of these series of chlorophyllose cellules, magnified about 600 times.] These at once suggest the slender vermiform cellules similarly interposed in the prosenchymatous tissue of the *Sphagna*, of which the office is precisely the same, namely to contain the grains of chlorophyll*.

Tribus 34. SPHAGNACEÆ, C. Mueller.

73. *Sphagnum*, Dillenius.

381. *S. acutifolium*, Ehrh. Crypt. exsicc. n. 72; Schwgr. Suppl. t. 5; M. P. 325.

Hab. Z₂ P. c. in rupibus humidis vallis *Lesponne* et secus lacum *Séculéjo*.

382. *S. cuspidatum*, Ehrh. Crypt. 251; Schwgr. Suppl. t. 6.

Hab. Z₀ P. occ. in turfosis prope *Dax* (Grateloup!).

383. *S. squarrosum*, W. et M. It. Suec. t. 2. f. 1; Schwgr. Suppl. t. 4; M. P. 326.

Hab. Z₂₋₃ P. occ. et c. in rupibus humidis, locis *Lesponne*, *Labassère* et *Mt. Crabioules*.

384. *S. cymbifolium*, Ehrh. Hann. Mag. 1780, p. 235; M. P. 327. *S. obtusifolium*, Ehrh.; H. et T. Musc. Brit. p. 13. t. 4.

Hab. Z₀₋₁ P. c. in rupibus humidis faucis *Gorge de Labassère* dictæ. P. occ. in palude turfæceo montis *Goursi*. Nusquam alias in montibus Pyrenæis mihi notum! In turfosis Agri Syrtici (Grateloup!).

385. *S. compactum*, Brid. Suppl. Musc. 1. p. 18; Schwgr. Suppl. t. 3; M. P. 328.

Hab. Z₀ P. occ. in Agro Syrtico, loco *Landes de Mugriet*, copiose.

Tribus 35. ANDREÆACEÆ, C. Mueller.

74. *Andreæa*, Ehrhart.

386. *A. Rothii*, W. et M. Cr. Germ. p. 386. t. 11; Schwgr. Suppl. t. 106; M. P. 329.

Hab. Z₂₋₄ P. c. in rupibus graniticis juxta lacum *Séculéjo*, necnon in valle *Castelloubon*; in rupibus micaceis ad marginem lacus *Lehou* (Philippe!).

* Since this account was drawn up, *Leucobryum glaucum* has appeared in the 'Bryologia Europæa' under the name of *Oncophorus glaucus*, and a description is given of its structure differing I believe in some slight particulars from what is here stated.

Florescentia monoica: flores *feminei* constanter *trigyni*; flores *masculi polyandri*, *paraphysibus claviformibus* præditi. *Folia* in dimidio superiori plerumque (in varietate *Grimsulana* præcipue) *seriebus cellularum duabus* conflata.

M. Philippe's specimens have the terminal leaves distinctly repando-dentate, and thinner than in the ordinary form of the species.

387. *A. rupestris*, L. Sp. Pl. p. 1601 (sub *Jungermannia*); Hedw. Sp. Musc. t. 7; M. P. 330.

Hab. Z₂₋₄ P. c. cum priore; etiam in rupibus dict. *Chaos* prope *Gavarnie*.

Florescentia monoica: flores *feminei di-trigyni*; flores *masculi tetrandri*, *paraphysibus carentes*, nonnunquam in planta propria pseudo-alares.

Ordo HEPATICÆ.

Tribus 1. JUNGERMANNIÆ, Nees ab E.

Hemicyclum 1. *Foliosæ*.

Subtribus 1. GYMNOTITRIA, N. ab E.

1. *Gymnotritium*, N. ab E.

1. *G. concinnum*, Lightf. Fl. Scot. 2. p. 786 (sub *Jungermannia*); Gottsche, Lindbg. et Nees, Syn. Hepat. p. 3; H. P. 1.

Hab. Z₂₋₄ in rupibus humidis P. occ. et c., locis *Pont d'Espagne* et *Port de Bénasque*.

2. *Sarcoscyphus*, Corda.

2. *S. adustus*, N. ab E. Europ. Leberm. 1. p. 120 (sub *Gymnotritio*); Syn. Hep. p. 4.

Hab. Z₁ P. c. ad saxa in monticulo *Olivet* prope *B.-de-Bigorre*, socio *S. Funckii*.

The habit of this species, the difficulty with which it is distinguished from small forms of *S. Funckii*, and above all the structure of the perianth, demand that it should be removed to the genus *Sarcoscyphus*. I find in all cases a *true perianth* present, the origin of which is derived from the union of two leaves quite concealed by the perichæatial leaves, with which it is *concrete* for nearly half its length: it is pale and of very delicate texture (cellules three times as large as those of the perichætium), erose and inflexed at the summit and sometimes 2-lipped. The perianth of *S. Funckii* is formed on the same type. In some true *Gymnotritia* (e. g. *G. concinnum*) I observe within the perichætium two leaves (rarely only one) which are much shorter, wider and more tender than the perichæatial leaves, and unequally trifid with toothed segments; but these are neither *connate* with each other nor *concrete* with the perichætium, hence they cannot be called a *perianth*, although obviously supplying the place of one. Still it would perhaps be more logical to consider *Gymnotritium* as only a section or subgenus of *Sarcoscyphus*. I am happy

to add that Dr. Gottsche quite concurs with me in the removal of *Gymnomitrium adustum* to *Sarcoscyphus*.

3. *S. Funckii*, W. et M. Bot. p. 422 (sub *Jungermannia*); Syn. Hep. p. 8; H. P. 3.

Hab. Z_{0-1} locis umbrosis ad terram saxaque. P. occ. *St. Sever*; *Jurançon*; *Val de Jéret*. P. c. *Bagnères-de-Bigorre*; *Vallée du Lys*.

4. *S. emarginatus*, Ehrh. Beitr. 3. p. 80 (sub *Jungermannia*); H. P. 2; Hook. Br. Jung. t. 27. *Sarcoscyphus Ehrharti*, Syn. Hep. p. 7.

Hab. Z_{0-5} ad rupes humidæ Pyrenæorum totorum; ad terram in sylvis Agri Syrtici.

3. *Alicularia*, Corda.

Obs. The two European species of this genus are both found in the Pyrenees, where *A. compressa* attains its southernmost recorded limit.

5. *A. compressa*, Hook. Brit. Jung. t. 58 (sub *Jung.*); Syn. Hep. p. 12; H. P. 4.

Hab. Z_1 P. occ. locis scaturiginosis faucis *Gorge de Cauterets* dictæ.

6. *A. scalaris*, Schrad.; Hook. Br. Jung. t. 61 (sub *Jung.*); Syn. Hep. p. 10; H. P. 5.

Hab. Z_{0-5} in rupibus, ad terram, &c., a planitie usque ad summos Pyrenæos ascendens.

4. *Southbya*, nov. gen.*

Char. essent. Perianthium terminale, involucro *emersum*, cum eodem *ab inferiori parte concretum*, primitus cylindricum dein a lateribus *subcompressum*, breviter *bilabiatum*, labiis subconniventibus, haud plicatum *suturis* tamen *duabus*, altera ventrali altera dorsali, notatum.

Genus inter *Aliculariam* et *Jungermannias integrifolias* medium locum tenens.

7. *Southbya tophacea*. (*Jungerm. tophacea* nobis in Hep. Pyren. n. 23.)

Hab. $Z_{1\text{ inf.}}$ in imis Pyrenæis occidentalibus, supra pagos *Jurançon* et *Gélos* in rupibus topha obtectis, cæspites *Weisia verticillatæ* marcidos haud raro vestiens; immo ad muros subhumidos in ipsa urbe *Pau*. E Lusitania sine nomine missa in herbario beati Taylor nuperius vidi.

* To no one can I with more propriety dedicate a new genus of Pyrenean Cryptogamia than to Dr. Southby, my companion in so many interesting excursions in those mountains, and a gentleman accomplished in almost every branch of natural history.

Plantæ pusillæ, tenerrimæ, $\frac{1}{4}$ — $\frac{3}{4}$ unc. longæ, cæspitosæ, matrice arcte adfixæ, instar *Jg. bicrenatæ* suaveolentes. Caulis simplex, rarius furcatus, e perianthii basi innovationes 1 vel 2 ante capsulæ maturationem involucri inclusas semper proferens, prostrata, apice fertili tamen assurgens, longis radiculis pallidis radicans. *Folia* pallide viridia, *inferiora* semiverticaliter affixa, subopposita, angulis dorsalibus subcontiguis nonnunquam connatis, reflexo-patula, ovata vel ovali-oblonga, apice rotundata, integerrima; *superiora* verticalia, plerumque conferta, *basi dorsali per paria conjuncta*, apice margineque ventrali solis reflexa, raro apice retusa, obtuse emarginata vel angulato-repanda; *involucralia* caulinis superioribus simillima, paulo majora, apice eroso-denticulata, cum perianthio ad basin concreta. *Amphigastrium* involucriale, ovato-lanceolatum, obtusum, nonnunquam adest; cæterum caulis omnino examphigastriata est. *Perianthium* terminale involucri subæquans (in plantis minoribus densifoliis nonnunquam involucri vix æquat, in elatioribus autem sparsifoliis involucri plus minus superat), e foliis duobus plus minus alte connatis conflatum et ex eo compressum bilabiatumque, labiis subconniventibus, post capsulæ emissionem haud raro collapsis, ore tametsi apertum, eroso-denticulatum rarius subincisum. *Textura* foliorum et perianthii est laxa, subpellucens, e cellulis majoribus in reti typice sexangularibus, limitibus angustis, intercalaribus nullis, granis chlorophyllicis magnis haud numerosis. *Calyptra* obovata, pallida, membranacea. *Capsula* fusca, subglobosa, tenera, laxe areolata, ad basin usque 4-valva aut, valvula una alterave bifida, 5–6-valva, pedicello pallido exserta. *Semina* grandiuscula, globosa, granulosa. *Elateres* torti, bispiri, apicibus subobtusis.

Florescentia dioica videtur. *Plantæ masculæ* foemineis tenuiores, tota fere longitudine staminiferæ. *Folia perigonia* minora, semper per paria connata, basi ventricosa, apice patula, stamina singula binave brevi-pedicellata circumscissim rumpentia in axillis foveantia.

TAB. III. Fig. 1, *plantæ nat. magn.*; fig. 2, *surculus sterilis a dorso visus*; fig. 3, *planta fertilis a latere visa*; fig. 4, *apex plantæ masc.*; fig. 5, *folia inferiora*; fig. 6, *folia superiora*; fig. 7, *apex folii*; fig. 8, *perianthium cum involucri a dorso visum*; fig. 9, *perianthium (effatum et collapsum) a latere, cum folio involucrali arcte retroflexo: omnia aucta.*

Obs. A first glance at this pretty species reminds one of *Alicularia scalaris*, but important differences are disclosed on a nearer examination; still, an extensive comparison of apparently cognate forms has convinced me that the *Aliculariæ* are in truth its closest allies. If a perianth of *Southbya* and one of *Alicularia scalaris* be vertically divided, and laid side by side, the relationship will be clearly obvious: the involucre is alike in both, and in both is it concrete below with the perianth, which also is formed on the same type in each. Could we now suppose the perianth of *A. scalaris* to be a little elongated, or that of *Southbya* to be a little abbreviated, the sole important difference would vanish. In reality, small forms of *Southbya* have the perianth sometimes barely visible beyond the involucre.

There is also a section of *Jungermannia*, consisting entirely of exotic species, which approaches *Southbya*, though more remotely. The type of this section is *Jg. turgescens*, Tayl. et Hook. fil. in Crypt. Antarctica, p. 38, t. 64, which has the *perianth slightly compressed laterally and truncate, but quite discrete from the involucre*. The habit too is widely different, the *stems being much divided*, scarcely radiculose, the *leaves very concave*, with a *minute guttulate areolation* (the cellules round, separated by wide interstices), and there are *bifid stipules* present. *Alicularia strongylophylla*, Eorund. l. c. p. 34, t. 62, has the *perianth exactly as in Jg. turgescens*, quite free and sometimes *twice as long as the involucre*; the chief differences being the *less concave leaves* and the wider areolation (yet still equally guttulate): *it is therefore not an Alicularia*, and with *Jg. turgescens* might well constitute a new genus, of which other species are probably *Jg. æquata* and *humilis* of the same authors. Possibly their *Alicularia occlusa* and the *Jungermannia Liebmanniana* of Lindenberg and Gottsche may go into the same genus, but of these I have not seen specimens. These species seem all intermediate between *Southbya* and the true *Jungermannia*, which they approach through *Jg. Taylora* and its allies.

On another side, *Southbya* has some affinity with a small group, of which *Jungermannia hyalina* is the European representative; but these differ from it in the *red radicles*, and in the *perianth being contracted and numerously plicate towards the mouth*.

[To be continued.]

XLIX. *Algæ Orientales*:—*Descriptions of new Species belonging to the genus Sargassum*. By R. K. GREVILLE, LL.D. &c.*

[Continued from p. 257.]

[With a Plate.]

At the moment when I have brought these descriptions of *Sargassa* to a close, I have learned that the first volume of the 'Genera et Species Algarum' by the younger Agardh, has appeared. This I was, of course, unprepared for, having never, in fact, even seen the work advertised. I would gladly have deferred bringing forward my present series of papers until I could have had the benefit of consulting that work, but it is now too late, and some confusion in nomenclature will be the probable result. It will be remembered that in commencing these descriptions I stated, that with few exceptions the subjects had been transmitted to me by my friend Dr. Wight for publication in the second volume of the 'Prod. Fl. Ind. Orientalis,' and that the interruption which had occurred in the continuation of that undertaking had induced me, after retaining my notes and drawings for many years,

* Read before the Botanical Society of Edinburgh, April 12, 1849.

to publish them in a modified form through the medium of the Botanical Society. It is quite possible that during such an interval of time the author of the 'Genera et Species Algarum' may have received from other travellers some of the species discovered by Dr. Wight, in which case there will inevitably be a collision of names; and although my manuscript has been lying by me for a long period, M. Agardh will have the unquestionable right which priority of publication confers. Where, however, we may have unfortunately described under different names the same plant, I may be allowed to hope that the figures which I have given will assist in removing the confusion.

19. *Sargassum gracile* (nob.); caule teretiusculo, filiformi; foliis linearibus, utrinque attenuatis, remote subdenticulatis, uninervi-bus; vesiculis parvis, subsphaericis, muticis, petiolatis, petiolis planis, dilatatis; receptaculis ramosis, axillaribus, lineari cuneatis, ad apicem compressis, acute et grosse dentatis.

Hab. in mari Peninsulæ Indiæ Orientalis; Wight.

Root I have not seen. *Plant*, as far as I can judge from the mutilated specimens before me, 2 or 3 feet in length or more. *Stem* cylindraceous, filiform, giving off numerous spreading branches at intervals of about one inch, and which are 6 inches to a foot or more long. These branches are clothed with others several inches in length, produced at shorter intervals, on which are situated the fruit-bearing ramuli. *Leaves* an inch long or more, about a line broad, linear, acuminate, almost entire, or remotely denticulate, furnished with a nerve and pores, and attenuated below into a very slender petiole. *Vesicles* about a line in diameter, subspherical, sometimes slightly pyriform, destitute of apiculus, supported on flat, foliaceous, dilated stalks, 1-1½ line in length, and produced from the raceme of fructification. *Receptacles* axillary, and occasionally also terminal, 1-2 lines long, linear-cuneate, cylindraceous and unarmed below, compressed and dilated above, and furnished at the margin and apex with large, sharp, often curved teeth. The receptacles form a sparingly divided raceme, one of the lower branches of which often terminates in a vesicle. Occasionally a receptacle becomes triquetrous in the upper part, in which case every angle is toothed: sometimes receptacles appear to be proliferous, suggesting the idea of a microscopic *Cactus*; at others they are long and slender to the apex which suddenly expands into a broad mass or crown of foliaceous teeth. *Colour* reddish brown. *Substance* slightly cartilaginous.

The habit of the entire plant is lax and slender.

20. *Sargassum leptophyllum* (nob.); caule brevi, tereti, tuberculato; ramis primariis compressis; foliis integerrimis, angustissime line-

aribus, attenuatis; vesiculis parvis, ovalibus, muticis, tuberculatis; receptaculis minutis, racemosis, axillaribus, cylindraceis, oblongis vel oblongo-cuneatis.

Hab. in mari Peninsulæ Indiæ Orientalis; Wight.

Root a small callous disc. *Stem*, in the single example before me, scarcely half an inch long, about as thick as a sparrow's quill, tuberculated. The very young branches which arise from this are quite flat and foliaceous, the young leaves having at first the character of pinnatifid expansions of the frond, afterwards becoming ovate or elliptical. The old branches are 1-2 feet long, compressed, about half a line broad, and begin to give off secondary branches several inches in length almost immediately, which in their turn bear a third series half an inch to an inch and a half long on which are produced the very short fertile ramuli. *Leaves* on the mature plant very numerous, an inch long or more, linear, attenuated, not half a line broad, quite entire, with a faint nerve and a few pores. *Vesicles* very numerous, oval, tuberculated with the prominent pores; those at the base of the small branches about a line in diameter; the rest much smaller; all supported on stalks 1-2 lines long, flat and very slender. *Receptacles* numerous, axillary, less than a line long, cylindraceous, oblong or somewhat cuneate, or partly divided, forming along with the vesicles a minute, considerably branched raceme.

A slender species, but well-clothed with branches, leaves, vesicles and fructification. It has a great resemblance in habit to *S. concinnum*, but differs widely in the fructification.

21. *Sargassum flexile* (nob.); caule tereti, filiformi; foliis caulinis linearibus, inciso-serratis, ramis angustissime linearibus, serrato-dentatis; vesiculis sphaericis, petiolatis, petiolis filiformibus; receptaculis cylindraceis, lineari-clavatis, in racemo laxo dispositis.

Sargassum angustifolium, Ag. Sp. Alg. vol. i. p. 32?

Hab. in mari Peninsulæ Indiæ Orientalis; Wight.

Root a callous disc, throwing up several stems, three feet or more long, terete, in my specimens not thicker than a sparrow's quill, giving off branches 3-12 inches in length at intervals of 1-2 inches. These branches bear a second series at short intervals, on which are situated the fruit-bearing ramuli. *Leaves*; those arising from young shoots close to the root, sessile, oblong or linear-lanceolate, obtuse, quite entire, furnished with a strong nerve reaching to the apex, and very minute pores. The *cauline leaves*, or those produced at the base of the primary branches, linear, an inch or more long, and above a line broad, somewhat acuminate, irregularly inciso-serrate, those towards the base of the stem more or less sessile. On the branches the leaves are about three-fourths of an inch long, a third of a line, or even still

less, in breadth, attenuated below into a capillary footstalk; the margin so finely toothed as to appear spinulose under a lens. There is a faint nerve, and notwithstanding the small space, scattered pores on each side. *Vesicles* spherical, about a line in diameter, on short filiform stalks, and found either at the base of the small branches or accompanying the racemes. *Receptacles* axillary, and occasionally terminal, cylindraceous, linear-clubshaped, smooth, a line or more long, forming a lax raceme with 2-5 branches, sometimes solitary. *Colour* pale reddish brown. *Substance* between cartilaginous and membranaceous.

As I do not possess an authentic specimen of *Sargassum angustifolium*, and as my copy of Turner's 'Historia Fucorum' is not at hand, I can only consult the character and description of that plant given by Agardh. And I find there so much that agrees with the Alga I have now before me, as to make me very doubtful whether the latter be really distinct. At the same time there are considerable discrepancies. No reference is made to the cauline leaves of my plant, which are very conspicuous. The leaves on the branches, which resemble those of *S. angustifolium* in their extreme narrowness, are not sessile as described by Agardh, but pass insensibly into long and very slender footstalks. The vesicles are *not* mucronate, nor are their little stalks dilated. Lastly, the receptacles are not "*subsolitaria*," but in racemes of several branches, and instead of being linear-lanceolate, are linear-clavate, obtuse and rounded at the apex. Under these circumstances I have thought it best to separate it in the meantime, and to give a figure which may assist in its ultimate determination.

EXPLANATION OF PLATE XI.

Sargassum gracile.

Fig. 1. Summit of a branch.

— 2. Receptacles and vesicle.

— 3. Receptacle crowned with a tuft of large semifoliateous teeth.
2 & 3 magnified.

Sargassum leptophyllum.

Fig. 1. A small branch.

— 2. Leaves on very short young shoots, springing from the root.

— 3. A leaf from the branches, with raceme of receptacles and vesicles.

— 4. Raceme.

— 5. Vesicles.

— 6. Do. with long foliateous stalks.

— 7. One of the same. 3, 4 and 7 magnified.

Sargassum flexile.

Fig. 1. Summit of a branch.

— 2. Cauline leaf.

— 3. Leaves on very short young shoots, springing from the root.

— 4. Portion of a branch from near the summit of the frond, with racemes.
The last magnified.

L.—*On the Mollusca of Vigo Bay in the North-west of Spain, by*
 ROBERT MACANDREW, Esq., F.L.S., *in a Letter to Professor*
 EDWARD FORBES, F.R.S.

To Richard Taylor, Esq.

DEAR SIR,

May 1849.

I SEND you a letter which I have lately received from Mr. MacAndrew, whose zeal in the cause of natural history has induced him to undertake a voyage in his yacht to Spain and Portugal, with the intention of exploring the sea-coasts of those countries by means of the dredge. The facts he has already brought to light, as mentioned in the following letter, are of the greatest interest both in a natural history and a geological point of view. His discovery of an isolated littoral marine fauna (and probably marine flora also) of a British or Celtic type intersecting the Lusitanian province, reminding us of the boreal outliers in our own seas, appears to support in an unexpected manner the theory I proposed in my memoir "On the Geological relations of the existing Flora and Fauna of the British Isles," published in the 'Memoirs of the Geological Survey of Great Britain for 1846,' wherein I maintained the former existence during the pliocene and pleistocene epochs of "a geological union or close approximation of the west of Ireland with the north of Spain." This I argued from the botanical features of Ireland and the Atlantic Islands, and from the geological phenomena which had occurred within the area in question since the eocene epoch. Had such a connexion existed, even as by means of it we had an Asturian flora transmitted northwards to Ireland, so along the coasts of the same land, littoral forms of mollusca, especially during the glacial period, when the tendency of conditions was to diffuse northern species southwards, would in all probability have been transmitted to the coasts of Spain. In no other way can we account for such a phenomenon as that made known in Mr. MacAndrew's letter. His discovery in Vigo bay of a colony of reversed *Fusi*, a race so characteristic of the red crag, supports this view most strongly, for in the southernmost beds of the Irish drift we find *Fusus contrarius* associated with a Spanish *Mitra* and *Purpura lapillus*, in the neighbourhood of the remains of a terrestrial flora of the Asturian type.

I remain, dear Sir, very truly yours,

EDWARD FORBES.

Faro, 8th April, 1849.

WE sailed from Portsmouth on the 9th and entered the port of Vigo on the 14th ult. Being ordered to perform a quarantine of ten days, we proceeded at once to the Lazaretto of St. Simon,

which is situated six or seven miles above Vigo, and about fourteen miles from the entrance of the bay. It occupies two small islands connected together by a stone bridge. We had the run of the larger island, which may be 200 yards in length; it is composed of granite, the component substances of which are so arranged as in some parts to afford masses of talc of the bulk of several inches. After diligent search I could only find five species of land shells, viz. *Helix aspersa*, *H. caperata*, *H. cellaria*, *H. nemoralis*, and a *Helix* resembling in general appearance *H. barbata*, but toothed, the lip red. I obtained permission to dredge, but upon condition of taking the guard in the boat with me, and not passing the limits of that part of the quarantine ground appropriated to vessels bringing clean bills of health. The locality was by no means favourable, the depth nowhere exceeding three to four fathoms, and the bottom consisting of filthy black mud. I obtained about eighty species of shells from it, all of which, with the exception of about six, are known inhabitants of the British Islands; and it strikes me as a remarkable circumstance, that the mollusca of that locality are more nearly allied to the British and less to the Mediterranean than those of the coast of Asturias, which is further north and with a northern aspect. In the latter district, *Purpura lapillus* which abounds here is replaced by *P. Hæmastoma*. The neighbouring town of Redondela is celebrated for its oysters, which are indeed of excellent quality; they are procured by means of a kind of rake from shallow water towards the head of the lock or 'via,' and in great abundance. On the 24th we were released from quarantine, anchored in front of the town, and employed the following week in dredging over a more extended area of the bay. The bottom, except near shore, consists of mud, a kind of blue clay; it varies in depth from eight or ten to twenty-five fathoms. *Laminariæ* grow in shallow water as in Britain, but in no great abundance. The geological formation of surrounding country is all granite as far as I had an opportunity of noticing it. I annex a list of the species procured, but you are not to regard it as approaching to a perfect catalogue of the shells of Vigo bay. Indeed should I, as is my present intention, spend a week there on my way back to England, I hope to make considerable additions to the list. It is not necessary to call your attention to the singular fact that all the strictly littoral shells are identical with British species. The only exception that occurs to me is the *Mytilus Gallo-provincialis*, and that is doubtful. *Chiton rufus*, *Fusus contrarius* and some others, though occasionally found alive upon the shore, I do not consider to be littoral species. I was much interested in finding the last-named shell (*Fusus contrarius*) living. You will notice that I have again met with our acquaintance *Chemnitzia fene-*

strata; also the *Goodallia*, which probably does not extend much further south. We sailed from Vigo on the 2nd instant, but as for some time previously there had prevailed strong winds on shore, were not able to do anything with the dredge north of Cape Vincent. We made an attempt off the Berlings, eight or ten miles distant, but with 200 fathoms line could get no bottom. There was a very heavy swell. Off Cape St. Mary's, outside this port, I had a few hauls in from fifteen to thirty fathoms water, and obtained eighty or ninety species which form the materials of a dredging paper. The *Venus* from that locality appears to be intermediate between the *gallina* of the Mediterranean and *striata* of our seas, so that they may at last prove to be only varieties of the same species. We found thousands of live specimens of *Ditrupa subulata*, which consequently inhabits a shallower depth here than in the British seas. Of *Capsa castanea* we procured many valves, as on the coast of Cornwall, but no live specimen, which is singular. I am disappointed at not being able to dredge in this harbour, but it is composed of narrow muddy channels through an extensive marsh. The littoral species of mollusca are here quite Mediterranean. *Conus Mediterraneus*, *Cerithium vulgare*, *Murex truncatus* and *M. Brandaris* are about the most common. I have not yet seen any *Purpuræ*. On the *Zostera* at low water are found four or five species of *Trochus* distinct from those of Vigo; also *Rissoa labiosa* and *Phasianella Vieuxii*. *Cardium edule* is in great abundance and fine; likewise *Ostræa edulis* near the North bar. We saw no signs of *Laminariæ*.

Mollusca obtained in Vigo Bay, March 1849.

N.B. Those marked * were procured alive.

**Balanus tintinnabulum*.

**Balanus* — : common.

**Clitia verruca*.

**Acasta Montagui*.

Anatifa vulgaris.

Anatifa striata.

**Pollicipes cornucopia*: procured from rocks: sold abundantly in the market, and much esteemed for food.

**Dentalium entalis*: rare.

* — *dentalis* (angulated): abundant.

— *trachea*
— minute species } in nullipore.

**Spirorbis*: common British species; on fucus.

**Solen siliqua*: from sand at low water, and sold in the market.

— *ensis*: island of St. Simon.

Lyonsia striata: dredged two valves.

Lutraria oblonga: valves.

* — *elliptica*: sold in the market.

— *rugosa*: numerous valves on the shore: only two specimens dredged with united valves: appear to bury deep in the sand:

commissioned several people to procure them for me at a low spring tide, but without success : length $3\frac{1}{2}$ to $3\frac{3}{4}$ inches ; breadth $2\frac{1}{2}$ inches.

Scrobicularia piperata : valves on shore.

**Bornia corbuloides* ? sand and nullipore.

**Kellia suborbicularis* : in dead shells of *Pullastra virginea*.

Lepton squamosum : valves in sand.

**Montacuta bidentata* : mud.

**Corbula nucleus* : mud.

Næara cuspidata : valves : mud.

Pandora rostrata : sand.

**Thracia phaseolina* : sand.

**Saxicava arctica* : the minute mud variety first noticed by Hanley.

**Syndosmya alba* : mud (*Boysii*).

* ——— *tenuis* : mud (*Prismatica*).

**Psammobia vespertina* : sand : one live specimen from low water.

——— *tellinella* : valves : young.

**Tellina tenuis* : sand : common.

——— *donacina* : valves.

* ——— *distorta* : sand and nullipore.

——— *crassa* : one recent valve.

——— ? or *Lucina* : obliquely striated, valves (common at Gibraltar) radiated.

**Diodonta fragilis* : common on the shore : one live specimen.

Lucina lactea ? mud.

* ——— *rotundata* : mud.

* ——— *sinuosa* : rare : small.

* ——— *spinifera* : mud : common, but few living.

* ——— ——— var. ? smooth cream colour.

**Artemis exoleta* : sand at low water.

* ——— *lincta* : sand : more rare than preceding.

**Mactra subtruncata* : sand : common.

——— *truncata* : rare : sand.

Donax trunculus or *anatina* (I think latter).

Mesodesma donacina : shore : common.

Cytherea Chione : valves : shore.

* ——— minute common in nullipore and gravel.

**Astarte triangularis* (*Goodallia*) : nullipore : common.

**Venus verrucosa* : sand : common.

* ——— *striata* : mud : common.

* ——— *fasciata* : nullipore : common.

* ——— *ovata* : nullipore : common.

**Pullastra decussata* : low water.

——— *vulgaris* : low water.

——— *aurea* : shore.

* ——— *virginea* : nullipore and mud.

**Cardium edule* : shore : abundant.

* ——— *echinatum* : one live specimen.

* ——— *tuberculatum* : one live specimen.

* ——— *ciliare* : mud : common.

- **Cardium lævigatum* : nullipore and gravel.
- *—— *parvum* ?
- *—— *scabrum* ?
- Arca tetragona* : valves : nullipore and gravel.
- *lactea* : valves.
- **Pectunculus pilosus* : nullipore and gravel.
- **Nucula nitida* : mud.
- Modiola tulipa* : valves.
- *—— *marmorata* : in an ascidia, &c.
- **Mytilus Gallo-provincialis* var. *dilatata* ? : common on rocks : byssus very strong.
- *—— *edulis* : on *Pollicipes* brought from entrance of the bay.
- Avicula* : two specimens and some fragments found on the shore.
- **Pecten maximus* : sand : could not identify any with certainty as *P. Jacobæus*. N.B. Suspect the latter to be only a variety.
- *—— *opercularis* : sand, &c. : small size.
- *varius* : valves : sand, &c.
- *obsoletus* : valves : sand, &c.
- *similis* : valves : sand, &c.
- *—— *distortus* : rocky ground.
- **Ostræa edulis* : abundant in shallow water near the head of the bay and of excellent quality.
- *—— *edulis* var. ? or *parasitica* ? : small size, in some parts covering the rocks.
- **Anomia ephippium* : abundant.
- **Crania persona* : on dead shells near the entrance of bay.
- **Chiton rufus* : very abundant : creeping on the sand along shore as well as attached to hard substances : some were always found on the chain cable.
- *—— *fascicularis* : on dead shells.
- *—— *marginatus* : under stones low water.
- *—— *cinereus* : on shells, &c.
- *—— *albus* ?
- *—— *ruber* ? or *lævis* ? : one specimen and a few minute.
- **Patella vulgata* : common.
- *pellucida* : one dead specimen.
- **Lottia virginea* : frequent.
- **Emarginula rosea* : one living, many dead.
- **Fissurella græca* : rare : not large.
- **Calyptræa sinensis* : abundant.
- **Bullæa aperta* : abundant : in mud, shallow water.
- **Bulla hydatis* : ditto ditto.
- *—— *akera* : ditto ditto.
- *—— *cylindrica* : mud : frequent.
- *truncata* : ditto ditto.
- *umbilicata* : mud : rare.
- *—— *lignaria* : one specimen.
- **Aplysia* : rocks, low water.
- **Rissoa ulva* : mud.
- *—— *vineta* : under stones, St. Simon's Island.

- * *Rissoa rufilabrum*? *Rissoa costulata*: one specimen.
 * — *interrupta*. — *costata*.
 * — *parva*. * — *labrosa*.
 — *pellucida*. * — *striata*.
 * — *calathiscus*. * — } not identified.
 * — *cimex*. * — }
Odostomia.
 * *Skenia*.
Alvanea albella.
 * *Chemnitzia elegantissima*.
 — *fenestrata*: sand, St. Simon's Island.
 — ? fragment of a large species.
 * *Eulima polita*: nullipora. * *Eulima subulata*: mud.
 * *Natica Alderi*: sand and mud.
 — *monilifera*? a dead imperfect specimen on the shore.
 * *Sigaretus perspicuus*: two specimens: animal of bright orange colour.
Haliotis: a fragment on the shore.
 * *Scalaria communis*: one alive and fragments.
 — *clathratulus*: one dead. *Scalaria Turtoni*: one fragment.
 * *Vermetus semisurrectus*? mud: large and abundant.
 * — *triqueter*.
 * *Solarium luteum*: one living. *Solarium* (unknown), dead.
 * *Trochus umbilicatus*: St. Simon's Island.
 * — *tumidus*: nullipore. * *Trochus striatus*: sand.
 * — *exiguus*: nullipore: abundant.
 * — *Montagui*: nullipore.
 * — *magus*: nullipore: abundant.
 — *Laugierii*: one dead specimen.
 * — *crassus*. * *Trochus cinereus*.
 * — *Zizyphinus*: rocky ground, &c.
Adeorbis: St. Simon's Island.
 * *Phasianella pullus*.
Lacuna puteolus: one dead.
 * *Littorina littoreus*. * *Littorina neritoides*.
 * *Turritella terebra*: very produced: rare.
 * — *implicata*? abundant.
 * *Cerithium reticulatum*: abundant.
 — *adversum*: a fragment.
 * *Pleurotoma attenuatum*. *Pleurotoma Maravigni*: one dead.
 — *coarctatum*? * — *Ginninianum*.
 — *costatum*? — *Boothii*?
 * — *lineare*: one live specimen.
 * *Fusus contrarius*: seven live specimens from the shore near rocks at low water.
 — *muricatus*.
 * — *corallinus*: animal bright scarlet.
 — ? carinated, somewhat resembling *Purpura lapillus*, dead.
 * *Murex erinaceus*: rocks at low water: some beautiful varieties.
 — *Edwardsii*: one dead.

- **Triton variegatum*. *Triton corrugatum* : dead.
 **Chenopus pes-pelican* : common.
 **Purpura lapillus* : St. Simon's Island, full-sized white ; Vigo small, dark colour.
 **Nassa reticulata* : abundant : dark-coloured undulated variety at St. Simon's Island : mud.
 * — *macula* : sand. **Nassa varicosa* : mud.
 — : smooth, purple inside : banded : animal very active : extremely abundant in mud.
 **Buccinum minimum* : nullipore.
 **Ringicula auriculata* : very abundant in mud.
 **Erato laevis* : two live specimens : sand.
 **Cypræa europæa*.
 **Sepia*.
 **Octopus*.
Echinus : four species, one of which is new to me.
 Starfishes, four, identical with British.
Holothuriæ, } same as obtained in Bantry Bay.
Cucumariæ, }

ZOOPHYTES.

Alcyonium digitatum.
Pennatula (Mediterranean species).
Actiniæ : several.
 Various animals of genera unknown to me.

R. MACANDREW.

LI.—On the Identification of a new Genus of Parasitic Insects, Anthophorabia. By GEORGE NEWPORT, Esq., F.R.S. & L.S.

To the Editors of the Annals of Natural History.

GENTLEMEN,

London, May 21, 1849.

THE care which is always taken in the 'Annals and Magazine of Natural History' to preserve to zoological nomenclature in this country a character for precision and honesty, induces me to request your insertion in that Journal of the following description of a Chalcididous insect which I discovered in the years 1831 and 1832 in the nests of *Anthophora retusa* at Richborough in Kent, and communicated on the 20th of March last to a meeting of the Linnæan Society ; and also of some statement of facts connected with this communication.

Family CHALCIDIDÆ.

Genus *Anthophorabia*, Newp.

(Female.) Head broader than the thorax ; antennæ six-jointed, pilose, with the second, third, fourth and fifth joints nearly equal, the sixth long, oval ; thorax and abdomen of equal length ; wings with a median bifid nervure ; tarsi five-jointed.

(Male.) Antennæ four-jointed, basal joint arched, greatly dilated and excavated on the under surface, second joint cylindrical, third large, globose, fourth elongated, oval*; eyes stemmatous; wings abbreviated. Length 1 line.

SPECIES.—*A. retusa*, Newp. *Female* bronze green, legs yellowish. *Male* yellow or deep ferruginous, stemmata blackish; *larva* sub-cylindrical, formed of fourteen segments, and slightly attenuated at each extremity.

Found in the cells of *Anthophora* at Richborough, Kent.

Although I had found this insect in all its stages of development, had made carefully finished drawings of it, and of its details in 1831 and 1832, and had showed these at that time to many friends, of which I have ample proof, I delayed to publish any account of it until recently, because I had intended to have done this in connexion with some facts of anatomy not yet put forth. Being engaged, however, in investigating the relation which subsists between the special anatomy of animals and the peculiarities in their œconomy and instincts, the male of this insect appeared to me to offer a good exemplification of my views in the peculiarities of its organs of vision, as compared with what I had seen and known of its habits. But as I could not find any description of the insect in any entomological work to which I had access, it became necessary for me to characterize and name it, that others might be able to identify it, before any references to it could be of value to science. I did this in the first part of a paper read to the Linnæan Society on the 20th of March last, and the description above given was printed in the report of the meeting of that Society inserted in the 'Gardeners' Chronicle' for the 24th of March, No. 12, page 183. The description and naming of the insect were thus but incidental to the chief object of my paper; and my claim to a scientific notification of the genus and species can only take date from that period, although I have known of the existence of this insect for nearly eighteen years. The particulars given in my paper of the place and time of its discovery were but as matters of history in connexion with its habits. Imagine then my surprise at the close of the reading of that portion of the paper at hearing the good faith of my statements abruptly questioned in some remarks addressed to the Society by Mr. John Obadiah Westwood, who made it appear that my knowledge of the insect *Anthophorabia* must have been derived from *vivâ voce* statements made by himself at a meeting of the Entomological Society in July 1847, when he referred to an undescribed insect by the name of *Melittobia Audouinii*, and

* It is probable that the large terminal joint of the antennæ, both in the male and female, may be formed by the union of two or more joints in one mass.

where, he asserted, I had seen his drawings of it, which I instantly denied. *Six weeks* after this aspersion, and *after* I had adduced—at the reading of the second part of my paper to the Linnæan Society on the 1st of May instant—living evidence of the truth of my previous announcement, Mr. Westwood disclaimed having doubted my discovery of *Anthophorabia* in 1832, and also disclaimed having cast any imputation on my statements. But *six days* later, May 7th, he appears to have addressed himself a second time *vivâ voce* to a meeting of the Entomological Society, at which I was not present, and at which he well knew, as I have ceased to be a Member, that I was not likely to be present to reply to his assertions. In the carefully drawn up report of that meeting, printed in the ‘Gardeners’ Chronicle’ on the 12th of May, No. 19, page 295, he again repudiates, yet at the same instant reconveys the imputation, and there, for the first time, prints his description of *Melittobia*, and claims to have described this insect sufficiently in 1847. Now the facts are these:—In the second volume of Mr. Westwood’s ‘Introduction,’ page 160, and printed in November 1839, the author refers to an insect found in France by M. Audouin in the nests of *Odynerus*, *Anthophora* and *Osmia*, and says, “*the male has most singular antennæ, and minute rudiments of wings,*” and then remarks, “*the species has not yet been described.*” Nearly eight years elapsed and no description of the insect had been published by M. Audouin, nor had any reference again been made to it by Mr. Westwood until July 1847, when, according to the printed Proceedings of the Entomological Society, vol. v. part 3. p. xviii, he “*exhibited specimens and drawings*” of Audouin’s insect, and mentioned that “*the antennæ of the males are singularly distorted (!) and the wings almost rudimental; thus offering a strikingly opposite analogy (!?) to other bee-parasites, such as Stylops, Meloë and Sitaris,*” and for this insect he proposed the name of “*Melittobia Audouinii.*” This is the whole that he had published respecting it, and those are his own words, Mr. Westwood being at that time Secretary of the Entomological Society, and enabled to prepare and to publish in the ‘Proceedings’ what he pleased. But every naturalist will perceive that neither of these extracts constitutes a description of the insect named; these vague allusions being equally applicable to other genera of Chalcididous insects. No entomologist advanced beyond his schoolboy days will contend that “*most singular antennæ*” or “*singularly distorted antennæ*” are descriptive terms or phrases. They apply equally well to at least four other genera of this family of insects, and of which three have been characterized by Mr. Westwood himself, viz. *Tetracnemus*, *Di cladocerus*, *Elasmus*, and *Eulophus*; while “*minute rudiments of wings*” or “*wings almost rudimental*”

equally applies to Mr. Westwood's genus *Hemiptarsenus*, to which he has assigned this as a generic character of the male. To be sure, in the case of *Melittobia*, we have the "*strikingly opposite analogy*" in addition, but, unfortunately, this refers to "*Stylops*, *Meloë* and *Sitaris*," and even as regards them it is not explained in what this "*strikingly opposite analogy*" consists. Yet on these shallow pretensions Mr. Westwood questioned the accuracy of my statements, and now asserts that his insect and mine are identical, attempts to claim priority of description, and does not hesitate to declare in print, that "the facts (!) and characters" (?) he had given were "sufficient to identify the insect, and distinguish it from every known species of the family to which it belongs (!)." But not only does Mr. Westwood assert this sufficiency on his part, and the identity of the two insects, but discourteously affirms that my description of *Anthophorabia* is "*perfectly unintelligible*," and then, for some, no doubt, most cogent reasons best known to him, he heads his description published on the 12th of May as follows: "*Melittobia*, Westw. 1847; *Anthophorabia*, Newp. 1849." Now in this very description he has given the same number of characters for his insect, and has followed the exact order of notification of parts which I have followed in mine, published on the 24th of March; and while he modestly asserts that *six* out of the nine characters which I have given are erroneous, he has copied, in whole or in part, the very words I have employed, and the very order in which I have employed them in *five* out of these nine proscribed unintelligible characters! Is it probable that this could have been accidental on the part of one who is ever so especially alive to his own advantage? Will the reader believe that any one who has any regard for his own credit or for public opinion, could be capable of such an attempt at imposition on his patience and his judgement? Yet such are the facts, as a comparison of Mr. Westwood's description with mine in the 'Gardeners' Chronicle,' pages 295 and 183, will prove.

Whether the characters given for *Anthophorabia* are sufficient to identify the insect or not, I leave entirely to the decision of others. When these are compared with those now published of *Melittobia*, the asserted identity of the two insects appears to be extremely doubtful: thus the male *Anthophorabia* has ocelli instead of compound eyes; *Melittobia* is described as having neither compound eyes nor ocelli: *Anthophorabia* has the middle portion of the antenna "large and globose;" *Melittobia* has the corresponding portion of this organ "very small and subannulose."

But assuming for an instant, what Mr. Westwood is pleased to assert as a positive fact, that the two are identical, and *presuming* that his description corrects errors in detail in mine,

would this entitle him to claim priority of nomenclature while the chief characters I have given (the stemmatous eyes, and the great dilatation and excavation of the basilar and the enlargement of the middle joints of the antennæ in the male) remain for the identification of the insect? As well might I pretend that the discovery of external branchiæ, in the imago *Pteronarcys*, which had been overlooked, entitles me to sink Mr. Newman's name of that genus, and substitute one of my own.

The great object of nomenclature and structural description of external form, if I rightly apprehend, is *identification*. Now it happens that Mr. Westwood's name is attached in assent to a printed Report on Zoological Nomenclature adopted and published by a Committee of the British Association in 1842, and in which the following rules are announced:—"No person can subsequently claim an authority equal to that possessed by the person who is the first to *define* a new genus or *describe* a new species." "Unless a species or group is intelligibly defined when the name is given, it cannot be recognised by others, and the signification of the name is consequently lost. Two things are necessary before a zoological term can acquire any authority, viz. *definition* and *publication*. Definition properly implies a distinct exposition of essential characters, and in all cases we conceive this to be indispensable, &c." "To constitute *publication*, nothing short of the insertion of the above particulars in a printed book can be held sufficient." I have now but to ask whether Mr. Westwood has complied with the rules which he has thus assisted to establish, before attempting to supersede others; or whether he has not been one of the readiest to infringe them, as in the present instance, when they have not suited his convenience? It matters but little to me whether the name which I have given, or the one which he proposes for an insect, be ultimately adopted, as I can assure him that I have but little ambition to be regarded as a describer of species.

But I resist his encroachment on the principle of right, and I repudiate his unfounded assertions and assumptions as being equally derogatory to science and unfair to myself and others.

I am content to travel over what he may regard as humbler ground, to watch and experiment on function, and quietly endeavour to trace the connexion of this with anatomy, and to examine and compare internal as well as external organization, without aspiring to what the entomologist may look upon as an all-important consideration, the honour and dignity attached to the rare achievement of being the earliest to name and describe an insect,—an event equivalent in his mind, perhaps, to the discovery of a planet and the calculation of its orbit.

I remain, Gentlemen, yours very truly,

GEORGE NEWPORT.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

Feb. 22, 1849.—Read a paper, entitled “Description of an Infusory Animalcule allied to the genus *Notommata* of Ehrenberg, hitherto undescribed*.” By John Dalrymple, Esq., F.R.C.S.

The examination of various specimens of the animalcule described by the author, disclosed the dioecious character of one of the more highly organized of the rotiferous class of Infusoria, hitherto supposed to be androgenous. This discovery was first made by observing the difference in the form and development of the embryo while still enclosed in the ovisac of the parent animal. From the extreme transparency of this form of rotifer, it is possible to trace the progressive development of the young from the Græffian vesicle in the ovary to the period of mature gestation, when the embryo is expelled, the whole machinery of whose organs has been perfected while still within the body of the female.

Thus, although the young one observed in the ovisac, when nearly ready to be expelled, was in the great majority of instances a miniature portrait of the parent, yet occasionally an embryo was seen of a different aspect, within whose body a vesicle was discovered filled with actively moving spermatozoa.

A further investigation of the subject brought clear evidence of the functions performed by this male,—its copulation with the young females; but it also displayed the singular fact, that although the organs of reproduction and locomotion were highly developed, there was a total absence of those of assimilation; in fact, that neither mouth, nor stomach, nor other digestive cavity or glands, were present in its curious organization.

In the early part of the paper the author describes the anatomy of the female, which differs from the family of *Notommata* of Ehrenberg, in the absence of intestine and anal orifice, and forcipated or caudal foot. In every other respect the organization is so similar to that class, that the author believes the proper place for this animalcule to be in a *sub-genus* of *Notommata*.

In relation to physiology, the author submits a new theory of the mechanism of circulation and respiration in the general group of Rotifers, a subject which is but obscurely treated of by the great German observer, who appears to have believed in the existence of tubular vessels or true vascular system. The author thinks, however, that these functions are performed in a manner more resembling that of insects, viz. that the blood is contained in the general cavity of the animal and circulates round the lung, which is here represented by a contractile vesicle that receives and expels the water in which the animalcule lives, and so comes to be in intermediate relation with the air mixed with the water. The difference therefore between the aëration of the blood of insects and that of this rotifer is rather due to the difference of the media they respectively inhabit, than of design. In both, the blood is contained in a general

* [A paper on this subject by Mr. J. Brightwell, illustrated with a plate, appeared in the ‘Annals’ for September 1848.—Ed. *Ann. Nat. Hist.*]

cavity and brought in contact with the air, without the intervention of any true vascular system.

The beautiful transparency of the animal, and the facility with which the development of the ovum may be traced through all its stages, induces the author to believe it to be well-suited to the inquiries of the embryologist and of those who devote themselves to the study of the metamorphosis of cell into tissue.

This animalcule has hitherto been discovered only in a few situations (in Norfolk near Norwich, and in Warwickshire near Coventry), but it is believed, from the very general dispersion of Infusoria, that it may be more extensively met with, especially in the months of June, July, August and beginning of September.

The author concludes by expressing his belief that re-examination of the whole order of Rotifera is necessary to determine the disposition of the sexes, and to assign them their proper situation in the scale of animated beings.

BOTANICAL SOCIETY OF EDINBURGH.

May 10, 1849.—Professor Balfour, President, in the Chair.

The following communications were read :—

1. "Description of *Monormia*, Berkeley," by G. H. K. Thwaites, Esq., communicated by John Ralphs, Esq. This genus is allied to *Trichormus*, Allman, differing principally, if not solely, in its definite, linear frond, which encloses a single moniliform filament to be traced throughout all the peculiar convolutions of the frond. The vesicular cells are interstitial, and occur singly. The sporangia are numerous, and are first formed from the cells at the greatest distance from the vesicular cells. Without due attention *Monormia* might easily be mistaken for a species of *Nostoc*; but the mass formed by its convoluted frond is not enclosed by a common membranous pellicle as in that genus.

Monormia intricata occurs in slightly brackish waters in floating gelatinous masses, each about as large as a walnut, and usually of a reddish brown colour.

The paper concluded with a synoptical table of the genera of *Nostochineæ*, and will appear in the 'Annals of Natural History' and the Society's Transactions.

2. "On the Causes which determine the Limits of the different species of Vegetables in the North of Europe," by Robert Huish, Esq., F.L.S., communicated by William Wallace Fyfe, Esq. In this communication Mr. Huish gave a condensed view of the researches of M. Alphonse DeCandolle in this interesting department of botanical science.

Dr. Balfour exhibited plants of the following interesting species from the Royal Botanic Garden, and made remarks upon them, viz.: *Trichopilia tortilis*; *Maxillaria Harrisonii*; *Oxalis bupleurifolia*, a shrubby species from Brazil; *Cereus crinitus*; *Pinguicula grandiflora*, distinguished by the large size of the flower, length of spur and continuity of the segments of the corolla; *Xylophylla latifolia*; *Persea*

gratissima, the Avocado pear of the West Indies, at present in flower in the garden; *Aloe umbellata*, in flower; and *Weigelia rosea*, a hardy shrub, recently introduced from China, in flower.

Mr. Evans exhibited flowering specimens of the following plants from the Caledonian Horticultural Society's garden:—*Schivereckia podolica*; *Rubus arcticus*; *Androsace villosa*; *Veronica repens*; a curious variety of *Athyrium filix-femina* from Braemar; *Woodsia Ilvensis*; and a fine plant of *Paris quadrifolia*, from Arniston woods near Edinburgh.

MISCELLANEOUS.

Capnodium, novum Fungorum genus. Auctore C. MONTAGNE, D.M.

Peridium carnosum, polymorphum, lageniforme, clavatum aut ceranoideum, e duplici strato formatum, exteriori scilicet colorato celluloso, cellulis subirregularibus penta-hexagonis, parallelogrammis (in ostiolo) linearibusque, interiori mucilagineo hyalino fere anhisto, apice irregulariter rumpens, interdum ore fimbriatum. Nucleus gelatinosus. Sporidia subsena, oblonga, transversim triseptata tandem septis longitudinalibus subeuntibus cellulosa, fuscescentia, ascis late obovoideis vel clavatis, mox diffuenti-resorptis inclusæ.

Thallus superficialis, libere evolutus, nigrescens e floccis brevibus contortis ramosis, moniliformibus aut cylindricis articulatis fuscis dense intricatis compositus.—In Australia, America boreali, Gallia australi et media (ad Versalias) fructiferum inventum.—Locus in systemate prope *Antennariam*. Affinitates. Habitus *Antennariæ*, at *Scoriæ*, Fr. magis affine, cum et in hac nuperrime ascos inveni. Hinc inter *Gliotrichum* et *Scoriam* nulla adest analogia; similitudinem quamdam, saltem ab aspectus judicio, cum *Synalissa* habet. *Asterina* et *Meliola*, quæ *Capnodio* magis affines, in serie diversa, differunt, prima autem floccis seu fibrillis folio matricive applicatis nec liberis, nec erectis, ultima vero fibris setisve rigidis simplicibus longissimis, quibus horrent perithecia, quas perperam pro ostioliis aliqui habuerunt, utraque tandem ascis oligospermis, ut formam peritheciolorum globosam præteream. Quoad collum peridii elongatum, filiaut corniforme, interdum ore fimbriatum, ut et morphosim sporidiorum hoc nostrum genus a *Melanospora*, Corda, haud multum distare videtur.

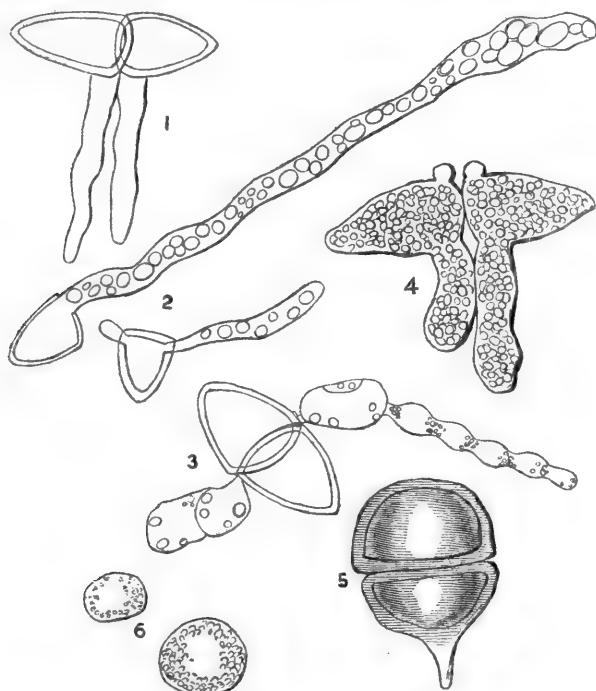
Typus generis *Capnodii*, *Fumago Citri*, Turpin, Mém. de Nosol. Végét. in Mém. Ac. Sc. de Paris, sav. étr. tom. vi. p. 240 cum icone, sed fructif. non intellecta nec visa. Ascus observavi in specie affini (*C. salicinum*) ad folia *Salicum* e sect. Cinerella, in Helvetia (d. Rof-favier) necnon cirçà Parisios (cl. Durieu) lecta.

PODISOMA FUSCUM.

There is a small group of Fungi, consisting of the two genera *Podisoma* and *Gymnosporangium*, and occurring only on different species of Juniper, which, in outward aspect, resemble exactly the gelatinous masses of certain *Tremellæ*, though in point of fact nearly

allied to the mildew of wheat. A very singular part of their œconomy is their reproduction year after year from the same mycelium, which forms discoid patches on the living stems exactly as in the curious genus *Cyttaria*, so important an article of food to the Fuegians, it gives rise to tubercles of various sizes on the living branches of various species of beech. A figure of one of the species, *Podisoma macropus*, Schwein., was published in the volume for 1845 of Sir W. J. Hooker's 'London Journal of Botany,' from a sketch by Dr. Wyman, who was so fortunate as to observe the germination. Mr. Woodward forwarded to me sketches illustrative of the germination from Cirencester in 1847, which confirmed the curious observations of the Messrs. Tulasne on the germination of Uredineæ, published in the early part of that year.

In April of the following year he was so good as to forward to me a specimen of *Podisoma fuscum*, which enabled both myself and Mr. Broome to observe the germination, and to secure sketches of the various phases which were exhibited. Professor Gasparini has lately published a memoir on the subject, which has not yet reached me.



Meanwhile I am anxious to record Mr. Woodward's observations, regretting that in the multitude of avocations I have neglected to do so at an earlier period. The spores vary extremely in different parts of the same tremelloid mass, being sometimes strongly pointed, sometimes perfectly obtuse; the pointed spores, however, seem the only

Figs. 1, 2, 3, 4, spores of *Podisoma fuscum*, germinating; fig. 2 shows clearly the protrusion of the cotyledonoid from the secondary membrane; fig. 5, a spore more obtuse than usual, which has not germinated; fig. 6, masses which appear to have escaped from the spores, and which eventually elongate into cotyledonoid threads. [We are indebted to the kindness of Dr. Lindley for the use of this woodcut.—R. T.]

ones which have the power of germination. Each spore consists of two cells, both of which are furnished on either side just above the point of juncture with a single pore through which the germinating thread protrudes exactly after the fashion of pollen tubes. Occasionally all the four pores are fertile, but more frequently one or two only protrude the cotyledonoid. The pores of the two cells, it should be observed, correspond exactly in position. In no case have more than two been observed in each hemispore.—*M.J.B.—Gard. Chron.*

METEOROLOGICAL OBSERVATIONS FOR APRIL 1849.

Chiswick.—April 1. Rain: fine: showery. 2. Densely clouded. 3. Fine: cloudy. 4. Foggy: rain. 5. Drizzly: fine. 6. Heavy dew: very fine. 7. Cloudy: drizzly. 8. Hazy. 9. Foggy: densely overcast. 10. Hazy: heavy clouds. 11. Cloudy and cold: clear and frosty at night. 12. Cloudy. 13. Rain. 14. Slight haze: fine: clear and frosty. 15. Rain. 16. Cloudy throughout. 17. Cold and dry: clear and frosty at night. 18. Clear: snow: cloudy. 19. Heavy fall of rain, sleet and hail throughout the day. 20. Snow and hail in forenoon, stormy showers: clear and frosty at night. 21. Clear: cloudy: clear and frosty. 22. Overcast: rain at night. 23. Rain. 24. Cloudy. 25. Drizzly: fine. 26. Rain: cloudy: clear: slight frost. 27. Foggy: cloudy: slight rain. 28. Fine: heavy showers: partly hail. 29. Slight haze: very fine: overcast. 30. Fine: clear.

Mean temperature of the month 44°·29

Mean temperature of April 1848 47°·33

Mean temperature of April for the last twenty-three years 47°·53

Average amount of rain in April 1·46 inch.

Boston.—April 1. Rain: rain A.M. 2. Cloudy: rain P.M. 3. Cloudy. 4. Fine. 5. Rain: rain A.M. and P.M. 6. Fine. 7. Fine: rain P.M. 8, 9. Rain: rain A.M. and P.M. 10. Rain: rain A.M. 11, 12. Cloudy. 13. Rain: rain A.M. and rain and snow P.M. 14. Cloudy: rain A.M. 15, 16. Cloudy. 17. Fine: snow P.M.: stormy. 18. Fine: rain and snow P.M. 19, 20. Cloudy. 21. Fine. 22, 23. Fine: rain P.M. 24, 25. Fine. 26. Cloudy: rain early A.M. 27. Fine. 28. Fine: rain P.M. 29, 30. Fine.

Applegarth Manse, Dumfries-shire.—April 1. Showers: thunder. 2. Spring showers. 3. Showers: thunder. 4. Frost: calm and fine. 5. Showers. 6. Fair: beautiful day. 7. Fair, but rigid and ungenial. 8. Slight shower A.M.: parching wind. 9, 10. Fair and chilly. 11. Fair and chilly: frost A.M. 12. Cloudy A.M.: rain P.M. 13. Frost: snow: hail: fine P.M. 14. Snow an inch deep: rain P.M. 15. Fair and fine. 16. Frost: slight shower of snow. 17. Frost very hard: shower of snow. 18. Frost: snow-showers: rain P.M. 19. Frost: shower of snow: fair and keen P.M. 20. Frost: clear and cold: slight shower of snow. 21. Frost very hard: clear and cold. 22. No frost: rain gentle: cloudy. 23. Rain: soft and warm: blessed change of weather. 24. Fine A.M.: grew cloudy: rain P.M. 25. Fine A.M.: shower of hail: rain. 26. Fine A.M.: shower. 27. Shower early: rain and wind P.M. 28. Growing day: one slight shower. 29. Fair and fine: cloudy P.M. 30. Most beautiful spring day.

Mean temperature of the month 42°·3

Mean temperature of April 1848 43°·2

Mean temperature of April for the last twenty-five years 44°·4

Rain in April 1848 2·52 inches.

Average amount of rain in April for the last twenty years 1·76 „

Sandwich Manse, Orkney.—April 1. Cloudy: rain. 2. Showers: drizzle. 3. Damp: showers. 4. Drizzle. 5. Damp: showers. 6. Damp. 7. Damp: cloudy. 8. Bright: clear. 9. Bright: cloudy. 10, 11. Cloudy. 12. Showers: cloudy. 13. Bright: cloudy. 14. Bright: clear: aurora. 15. Cloudy. 16. Snow-showers: snow. 17. Snow-showers: drift: snow-showers. 18. Snow-showers: frost: aurora. 19. Sleet: hail-showers: aurora. 20. Bright: frost: clear: aurora. 21. Bright: clear: aurora. 22. Cloudy. 23. Drops: cloudy. 24. Bright: hazy. 25. Clear. 26. Cloudy. 27. Clear. 28. Clear: very clear. 29, 30. Fine: cloudy.

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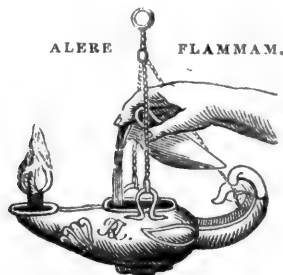
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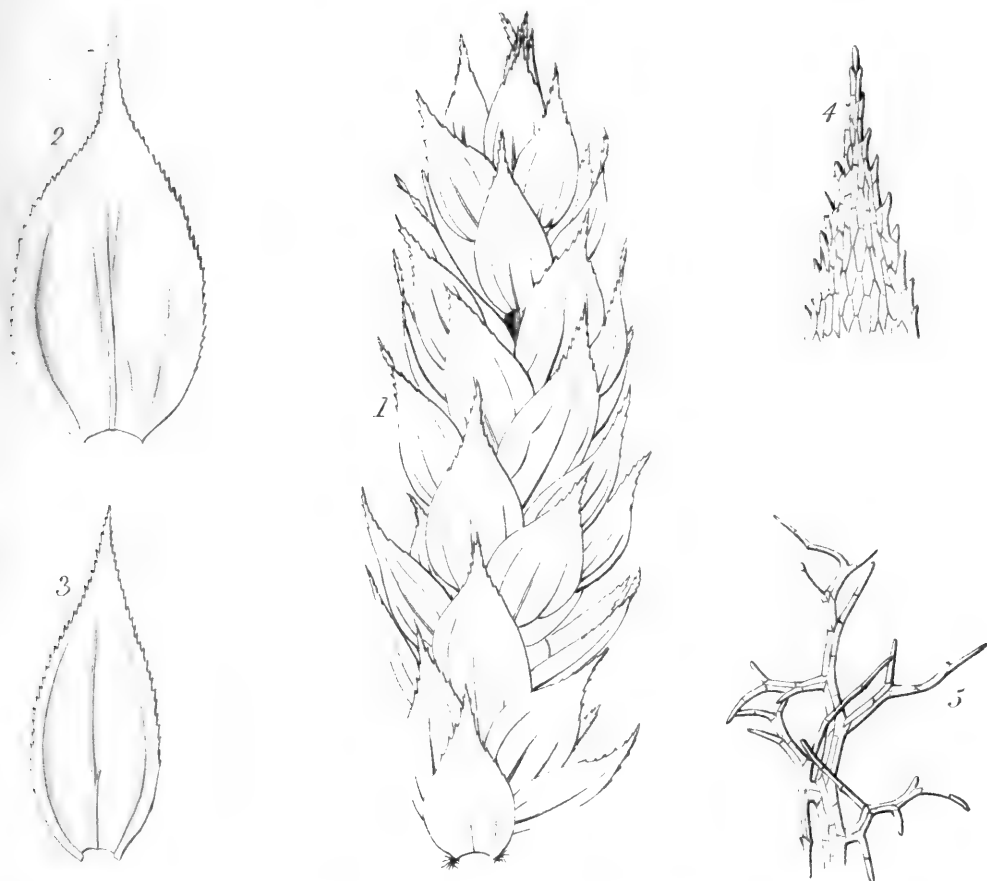
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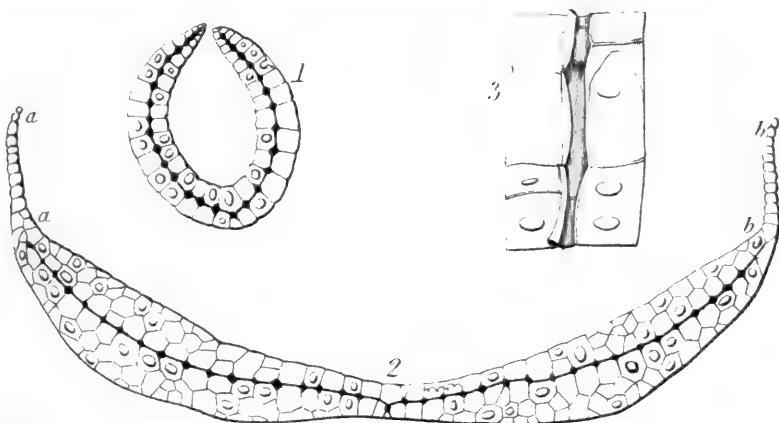
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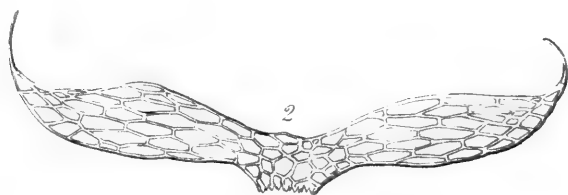
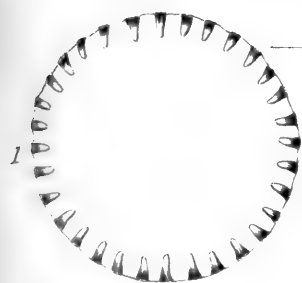




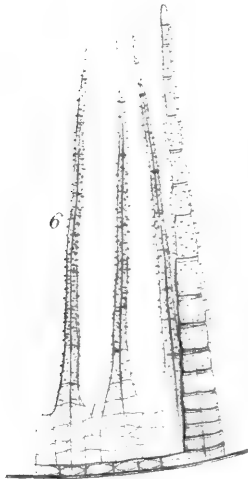
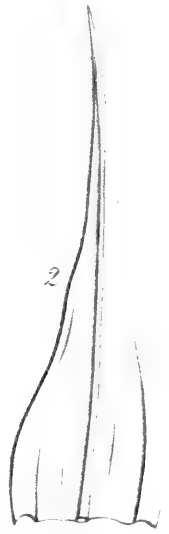
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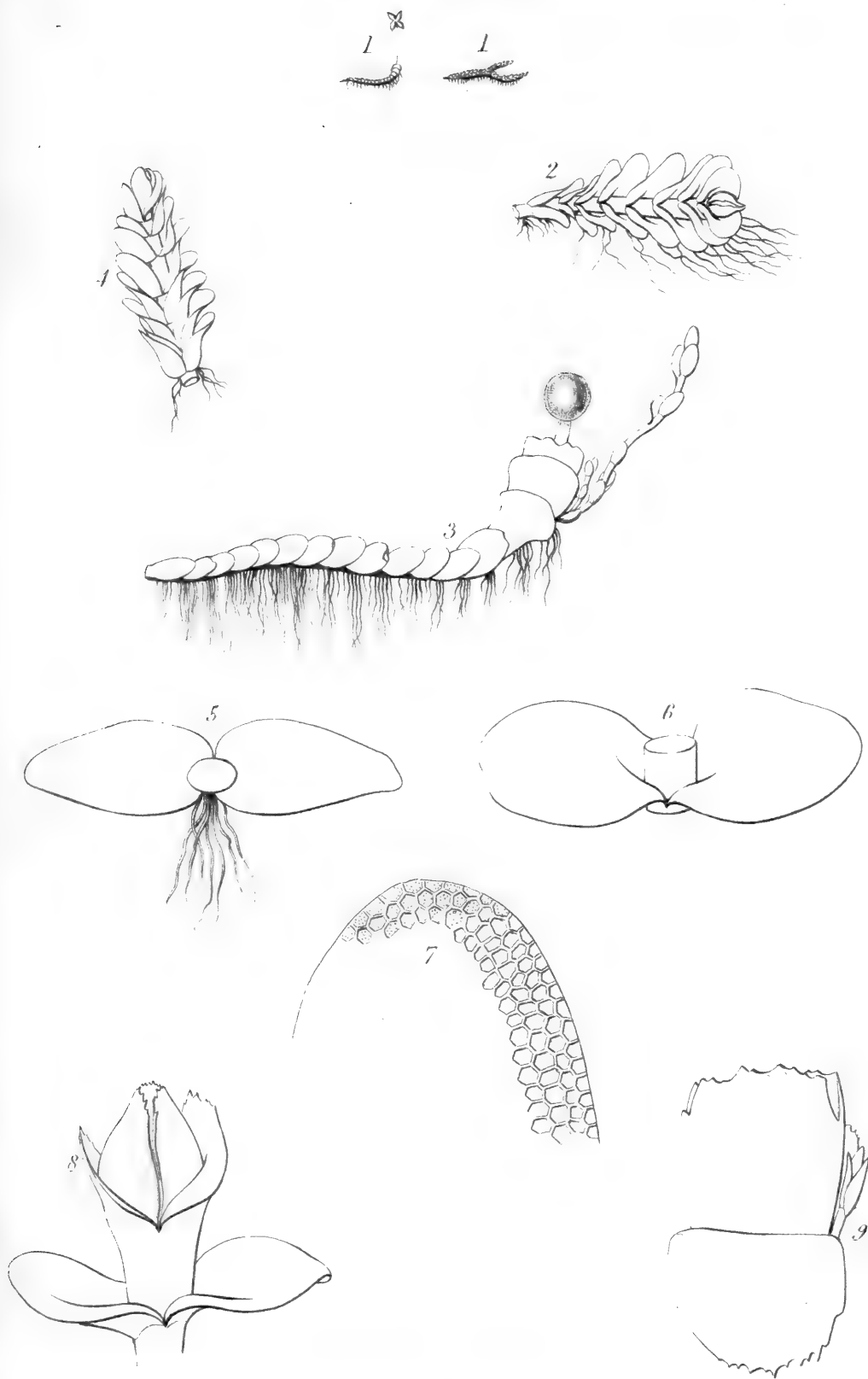
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Southbya tophacea.



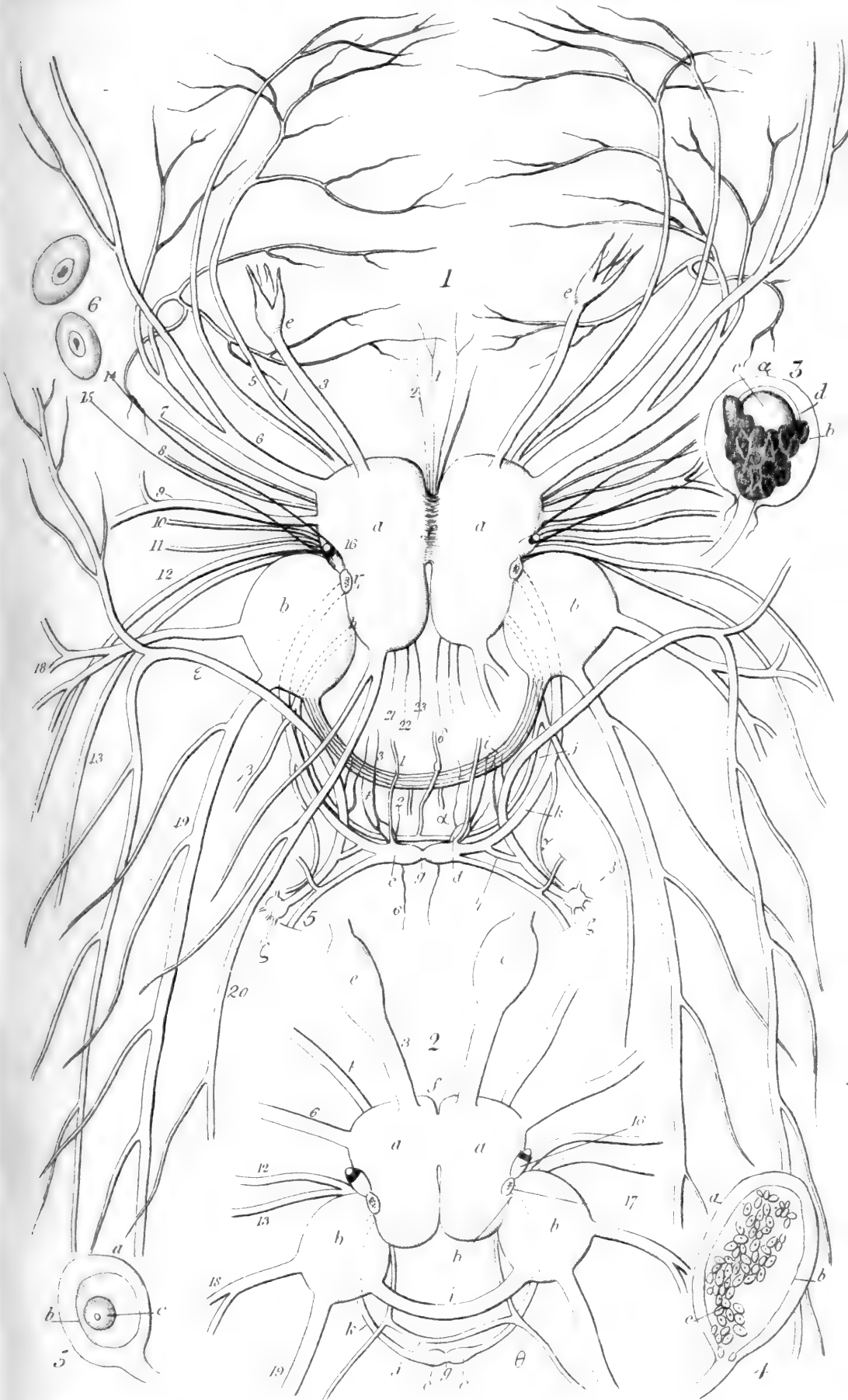
Sargassum porosum.

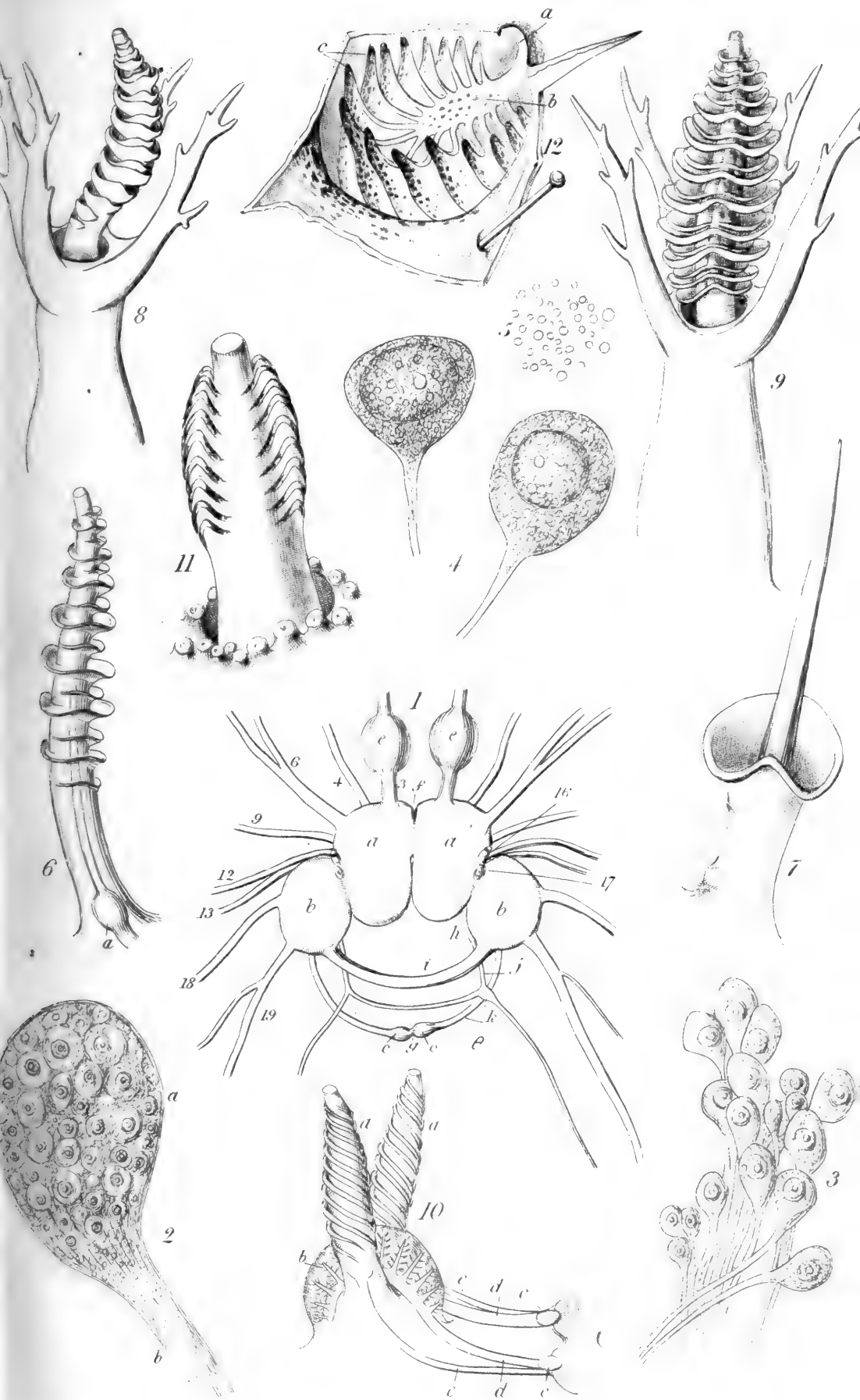


S. elegans.

S. brevifolium.



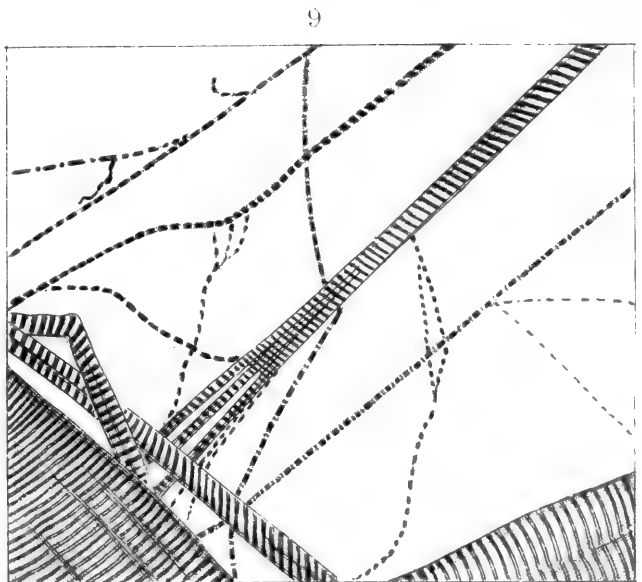
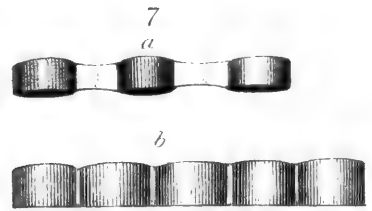
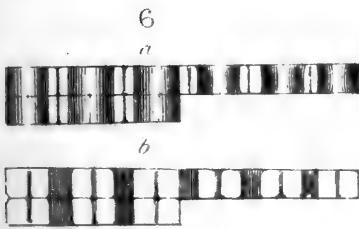
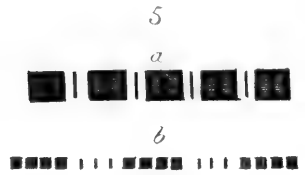
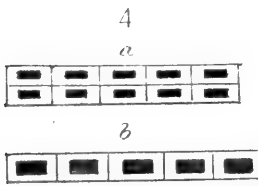
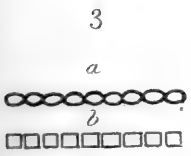
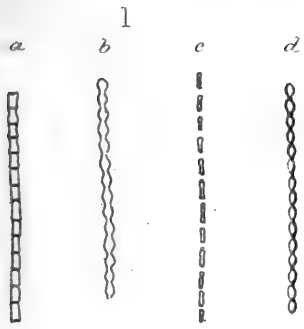




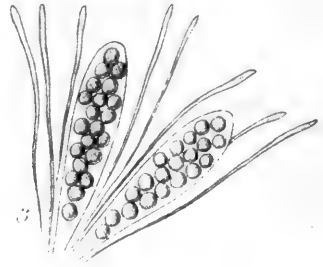
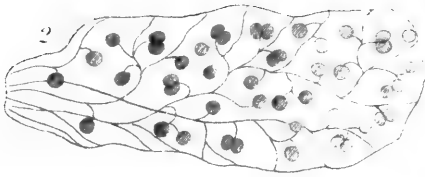
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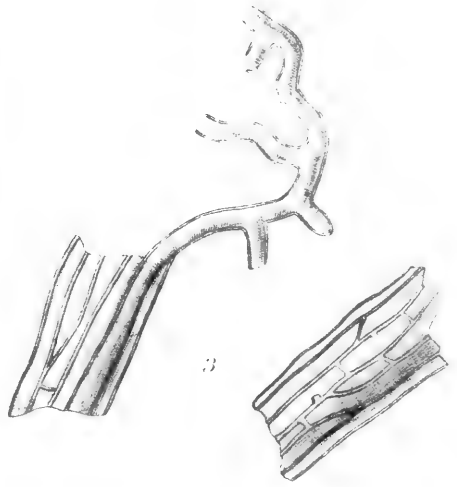


A



Synalissa vulgaris.

B



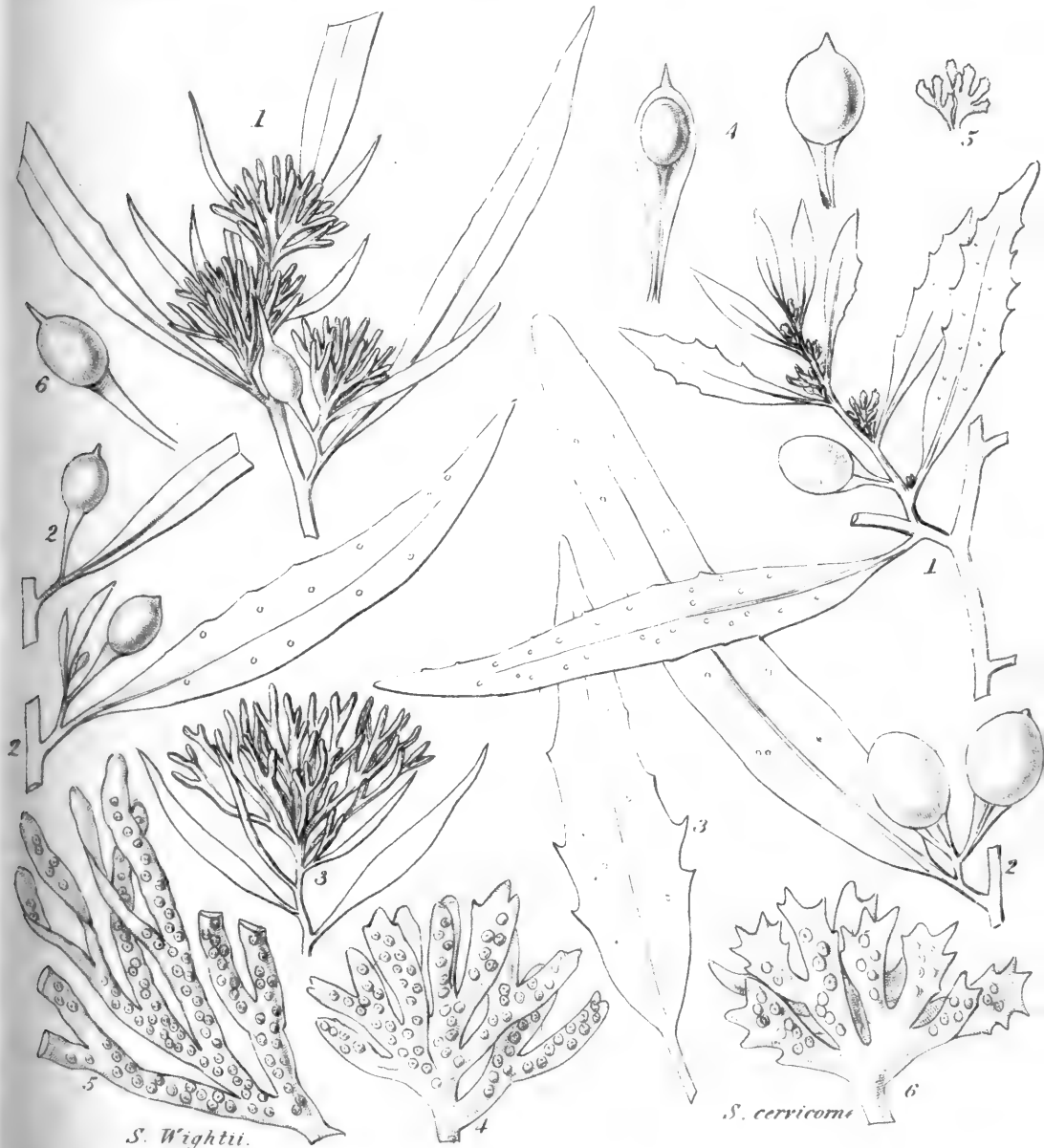
Cystocoleus ebeneus.



Coccochloris Brebissonii.



S. obovatum.



S. wrightii.

S. cervicornis.





Sargassum squarrosum.



S. divaricatum.

S. acutifolium.

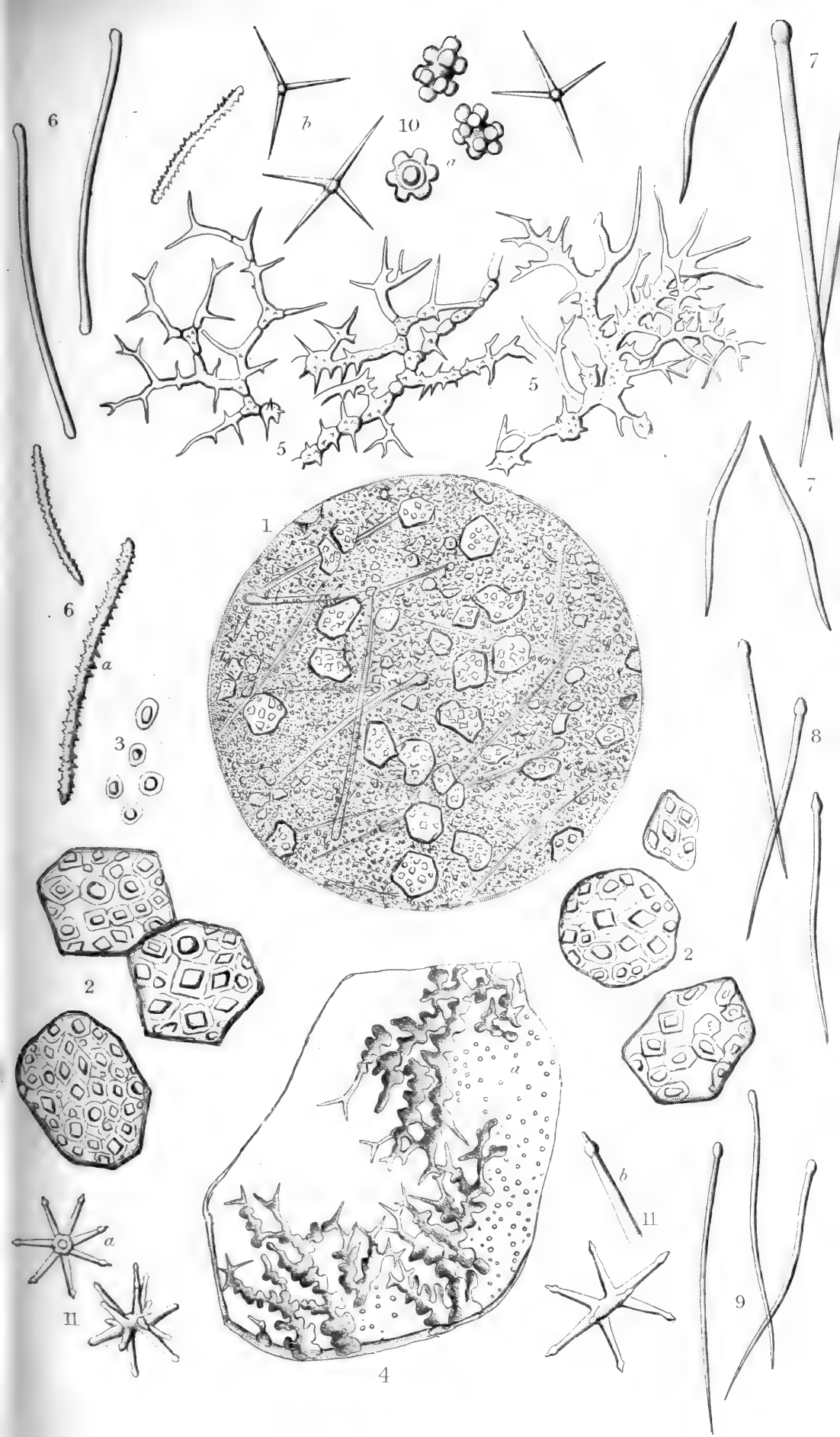


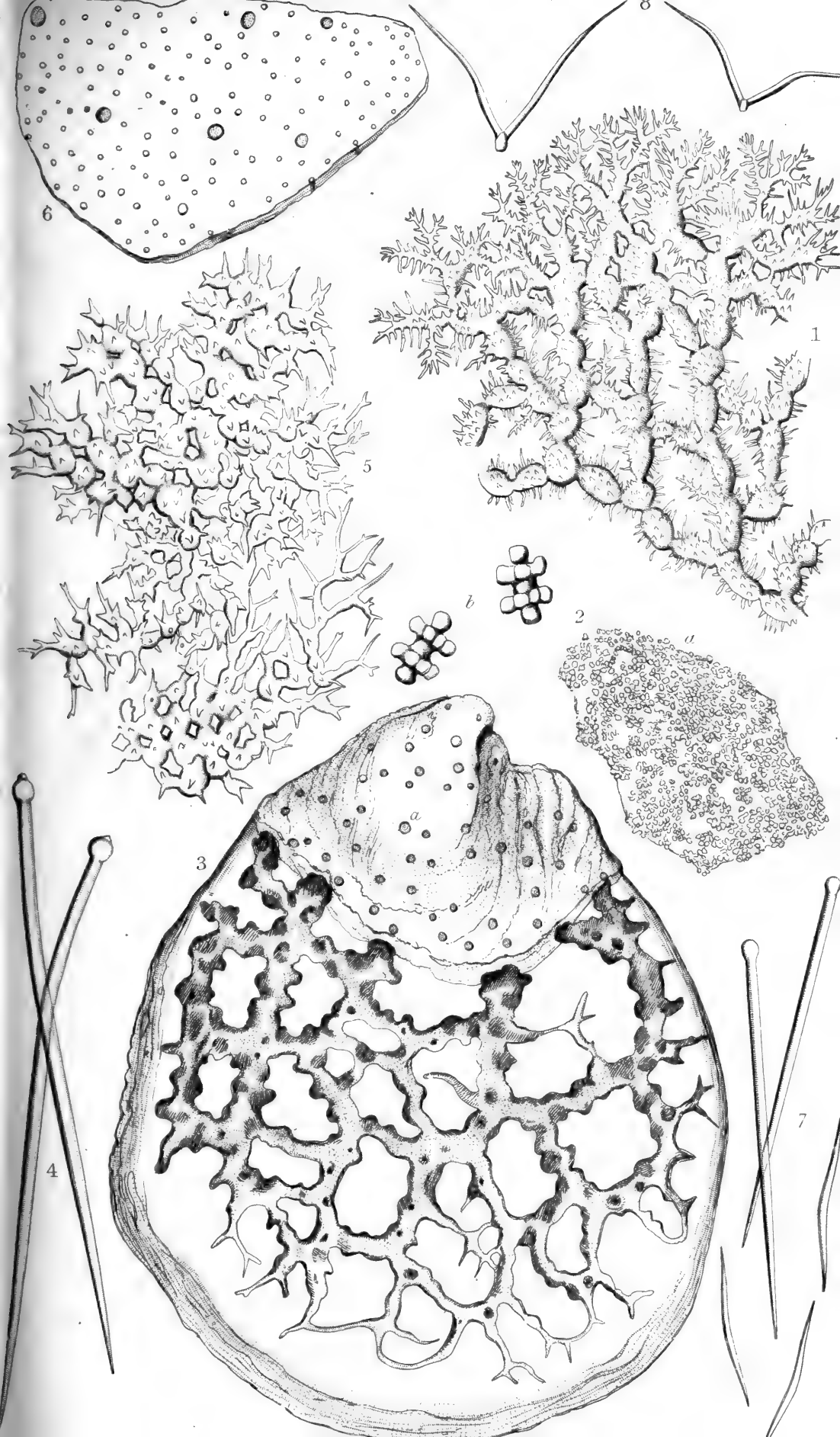
Sargassum gracile.

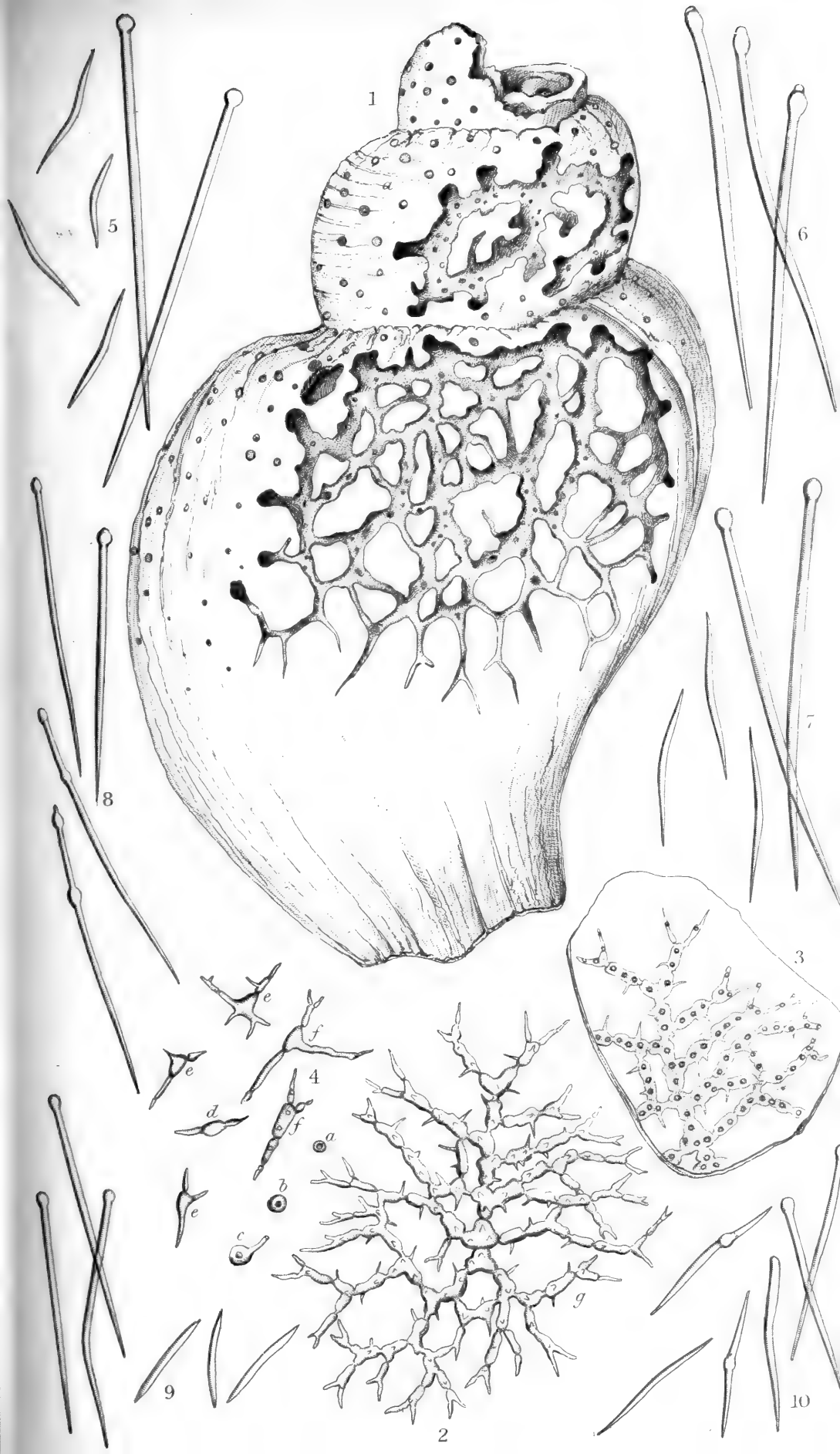


S. leptophyllum.

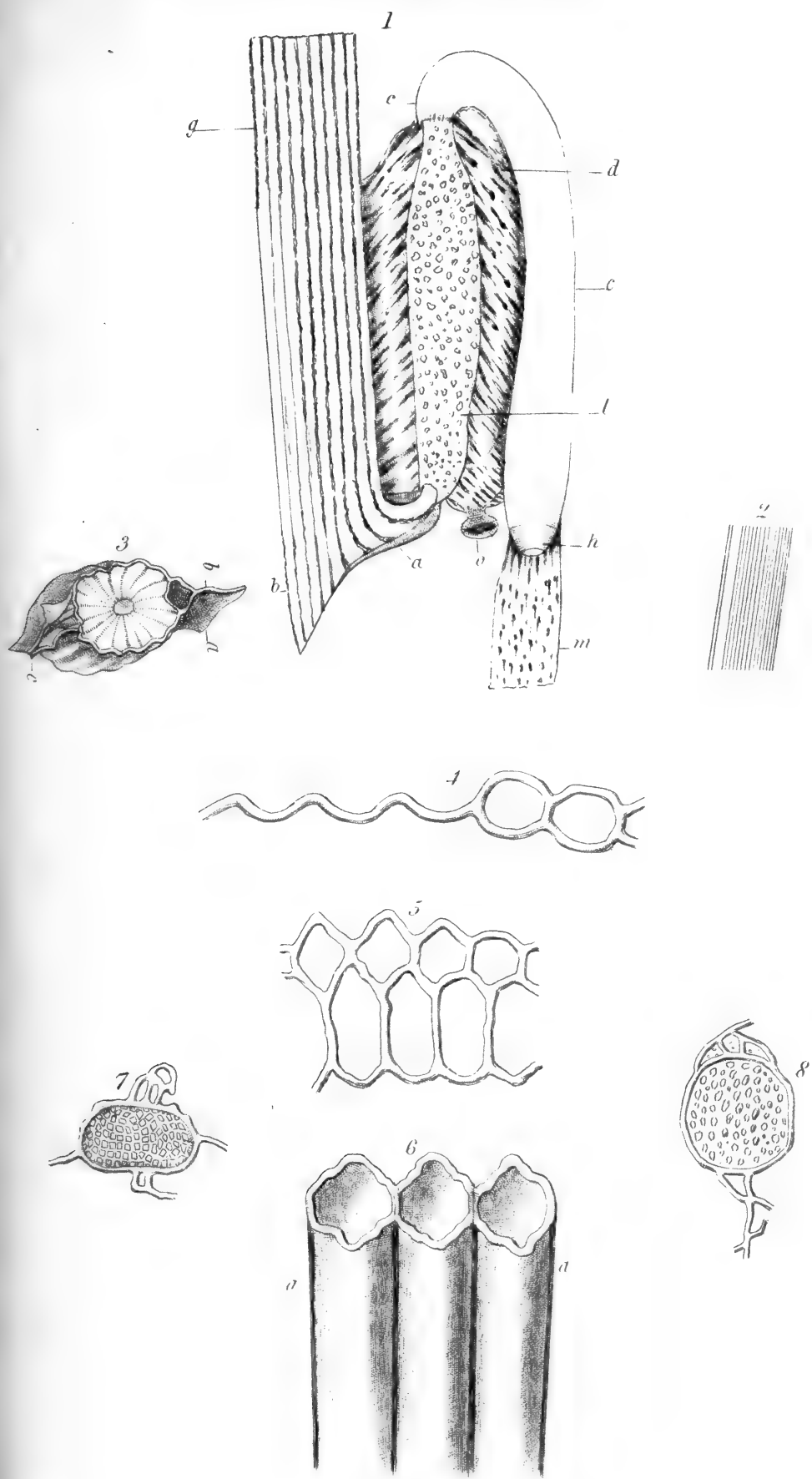
S. flexile.











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